

ANALYSIS OF USER REQUIREMENTS FOR
CENTRALS AND TERMINALS

INPUT

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INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out research. Working closely on important issues, INPUT's staff interpret the research data and make recommendations and innovations.

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Planning Services for Management

ANALYSIS OF USER REQUIREMENTS
FOR PERIPHERALS AND TERMINALS

SEPTEMBER 1983



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ANALYSIS OF USER REQUIREMENTS FOR PERIPHERALS AND TERMINALS

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I INTRODUCTION

I INTRODUCTION

- This report is produced by INPUT as part of the 1983 Field Service Program for the United States, for clients of that program.
- Planning for maintenance services (both hardware and software) should be based on user requirements and the level of satisfaction with present services. Therefore the first series of reports that INPUT publishes concentrates on this area.
- New issues, such as using field engineers in a sales role and customer involvement in the maintenance process, should be critically reviewed in light of what the users have to say.
- For this reason, INPUT has scheduled the user requirements series of reports to be delivered first.
- Each report concentrates on one area of the market. This present report is specific to peripheral and terminal users. In addition, each of the top eleven vendors is treated separately so that each may review its data against the norm.

A. DEMOGRAPHICS

- A total of 303 telephone interviews with users were completed. The vendor distribution is shown in Exhibit I-1. The titles of those interviewed are as follows:

- Director of data processing/information systems	22
- Data processing manager	85
- Operations manager	83
- Data processing supervisor	31
- Operators/specialists/programmers	<u>82</u>
	303
- The industry sector distribution of the users interviewed is indicated in Exhibit I-2.
- Two further vendors' individual statistics were not calculated because the low number of respondents did not provide sufficient data for meaningful analysis. They are, however, included in the total and affect overall vendor total.

B. METHODOLOGY

- The basis for the interviews was the questionnaire shown in Appendix A. The data obtained was entered on dBASE II's relational data base management system, and analyzed using ABSTAT. The resulting printouts were summarized to produce the Exhibits that are a part of this report.
- As with all reports, the data selections were arbitrary. Since each client receives a copy of the raw data in a printout and on floppy disk, further tabulation and analysis may be done as he/she sees fit. However, INPUT's hotline service is available for queries on the data.

EXHIBIT I-1

INTERVIEW SAMPLE BY VENDOR

VENDOR	INTERVIEWS	MAIN PRODUCTS
CDC	20	33XXX
Centronics	10	6000
Decision Data	20	6600
IBM	60	3420, 33XX, 3800, 3270
ITT	29	278, 277
Memorex	44	3226, 3640, 1377
Mohawk	20	21/10
NAS	21	7420, 7350
STC/Documation	40	34XX, 8650, 1200
Telex	15	270
Xerox	20	9700
Total	303	

EXHIBIT 1-2

PERIPHERALS AND TERMINALS USER SAMPLE BY INDUSTRIAL SECTOR

SECTOR	USER INTERVIEWS
Process Manufacturing	15
Discrete Manufacturing	122
Transportation	13
Utilities	9
Banking and Finance	12
Insurance	25
Medical	10
Education	19
Retail	7
Wholesale	4
Federal Government	3
State and Local Government	27
Services	33
Other	4
Total	303

- The data base file formats and methodology for their use are contained in Appendix B.
- Client comments on the usefulness of these data structures are welcomed, particularly in light of how INPUT can make the transfer of data to the clients' computers as easy and efficient as possible.

II EXECUTIVE SUMMARY

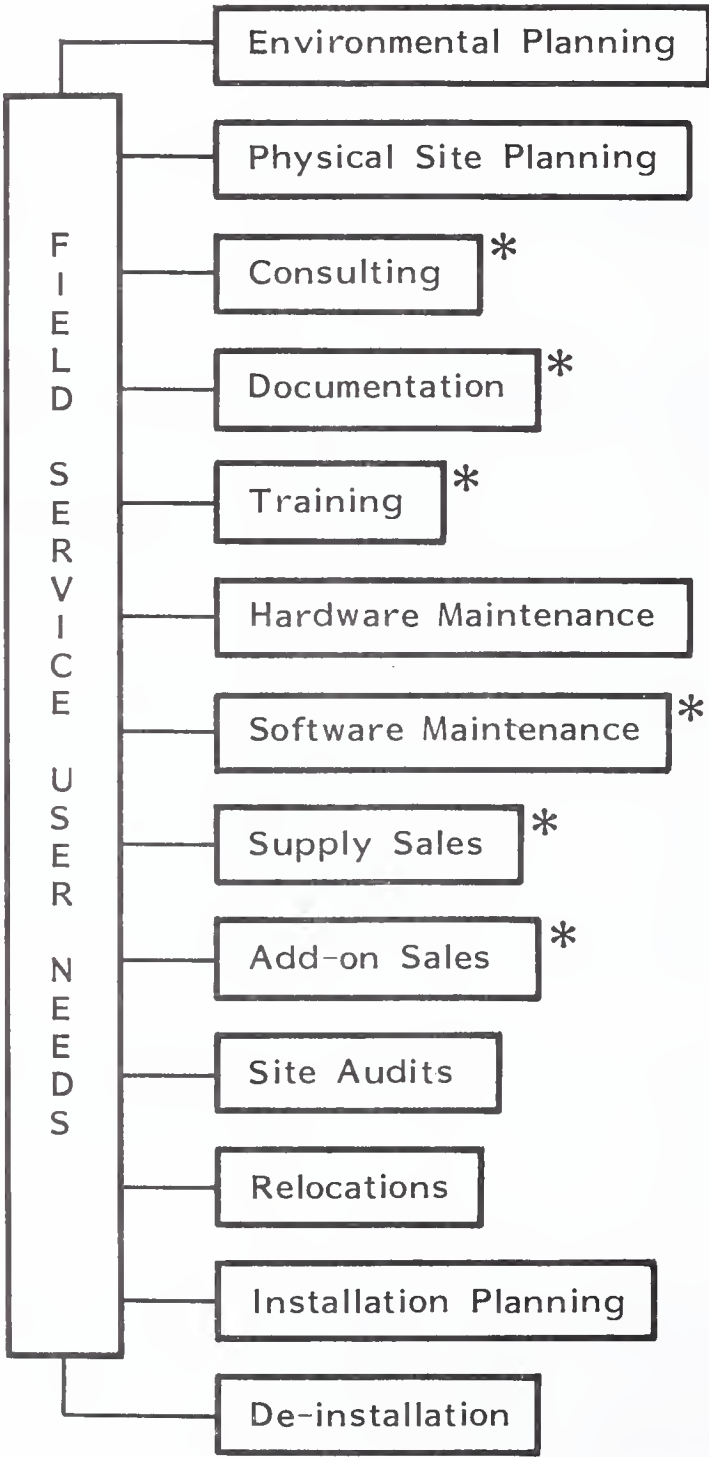
II EXECUTIVE SUMMARY

A. TOTAL SERVICE CONCEPT

- Peripheral and terminal service organizations are a mixed bag: some organizations were originally set up to maintain a full range of system equipment (including peripherals and terminals). Others specialized in specific products. Because of this, vendors' methods and attitudes toward maintenance vary.
- Over the past several years, large mainframe maintenance organizations have expanded the role of their field service groups to include software maintenance. With the advent of telecommunications, both local and remote, expansion will continue on the hardware front. It is also time to expand the role of the service organization in the post-sales area.
- Thus expansion will encompass a whole host of services. INPUT refers to this as the total service concept. The components of after-sales support are schematically shown in Exhibit II-1.
- Organizations that have always specialized in specific products (such as terminals and printers) will find it necessary to provide the ongoing training and consulting services, and resources that are required to offer to their clients a total service program.

EXHIBIT II-1

COMPONENTS OF AFTER-SALES SUPPORT SERVICES



* Not part of peripherals/terminals field service

- Although the user requirements for each of the components of total service are more evident in the large-system end of the product spectrum, these needs will surface throughout the industry as equipment configurations become more complex.
- While most organizations place elsewhere the responsibility for the functions highlighted in Exhibit II-I with an asterisk, the regular contact that field engineers have with the clients' DP management can fulfill these needs. The shifting of these functions to field service will be beneficial in all critical areas of the vendors' field organizations.

B. AFTER-SALES SUPPORT COMPONENTS

- The items listed in Exhibit II-I extend the responsibility of most field service groups. They are, however, logical functions for service organizations to assume responsibility for. This is particularly true in organizations where products are being modularly constructed to reduce maintenance requirements.
- The following items have traditionally been the responsibility of field service, although some vendors use third-party companies in many areas.
 - Environmental planning.
 - Physical site planning.
 - Site audits.
 - Relocations.
 - De-installations.

- Hardware maintenance.
- The following functions are handled in most organizations by vendor divisions other than field engineering.
 - System consulting - Today, most consulting services provided by the vendor are sales or marketing oriented. Users tend to depend upon independent consultants because of their availability and lack of bias. In the past, IBM used their own field resources to provide guidance for users. This philosophy built a customer base that was both dependent and loyal. IBM still provides effective consultant services to ensure future sales opportunities. IBM commits manpower and education to this philosophy. The field engineer (FE) visits a customer account more frequently than anyone else from IBM. If trained properly, the FE can be a valuable sales tool.
 - Training - User training is normally conducted by the sales and marketing support organizations at regional education centers. Field service could augment this by providing operator training at the customer location. Field service should not be used to replace existing programs; they should only assist when required.
 - Documentation - There are several levels of documentation used by customer personnel. Although the survey reveals that documentation is not a serious problem for peripheral users, several vendors are starting to use field service personnel to ensure that material is written to the right audience. This has been helpful and should be considered by all vendors.
 - Supply sales - According to the survey, users oppose field service involvement in supply sales. Although no specific reason is given, they may feel this would distract field service from its primary function.

This is in direct contradiction to the results of the large-system and small-system user ratings.

- Add-on sales - Since field engineers have frequent contacts with the user, their knowledge of the user's operation is current. FEs can greatly assist or take responsibility for add-on sales. This is an area of clear opportunity for increased vendor revenues.
- Software maintenance - Software maintenance, although not as critical to peripherals users, is an area where field service can be very effective (with the exception of intelligent peripherals that have software content). By combining software and hardware service, increased field resources are made available. Greater overall customer satisfaction will be realized.

C. REQUIREMENTS VERSUS SERVICE (CURRENT)

- Within the peripheral survey, only in hardware maintenance were user requirements above 7.0. This differs greatly from the large and small system user requirements. When calculating survey results, only the respondents were used, therefore some totals will not always balance. In the case of Beehive and Northern Telecom, only a small user population responded. The information was used in the aggregate but was not large enough for meaningful individual vendor conclusions. Therefore, these two vendors were eliminated from the individual analyses.
- For vendors with equipment that was surveyed in the large system or small system user requirements reports, information should be compared and merged for more meaningful results.

- On an overall basis, vendors provide a higher average level of service than users require in all surveyed areas except training, software maintenance, supply sales, and site audits. These four areas also show a percentage of user dissatisfaction in excess of 25%.
- The provided level of hardware maintenance exceeded requirements; nevertheless, this area showed the highest percentage of user dissatisfaction at 39%.
- The level of user dissatisfaction is lower overall in the peripheral and terminal portion of the systems business. No area shows a percentage of dissatisfaction over 39%. The level of service required is also generally lower than other sections of the industry surveyed. There are areas of overkill, which should be investigated, but overall, vendors are doing a good job.
- Exhibit II-2 graphically displays the summarized results of user requirements versus vendor services provided.

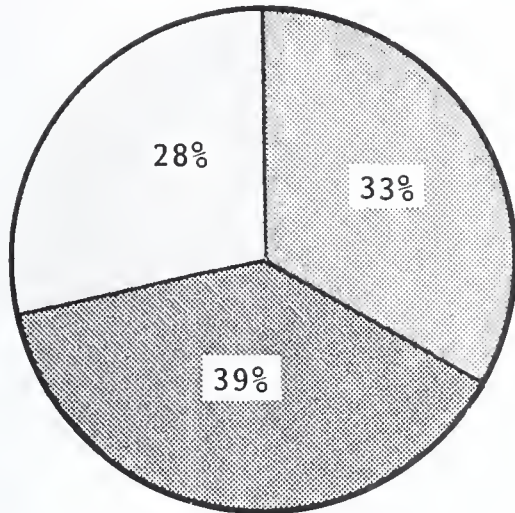
D. USER RATINGS OF VENDORS

- Due to the various types of products within the surveyed group, results vary considerably. Exhibit II-3 shows results by vendor in a summarized table, but does not compare one vendor to another (because users are comparing services provided to services required, not the services of one vendor compared to another).
- Some surprising results emerge:
 - Hardware and software maintenance services score lower than all other items surveyed; this does not mean that service is poor, but that the level of service provided overall is lower than the average user's needs.

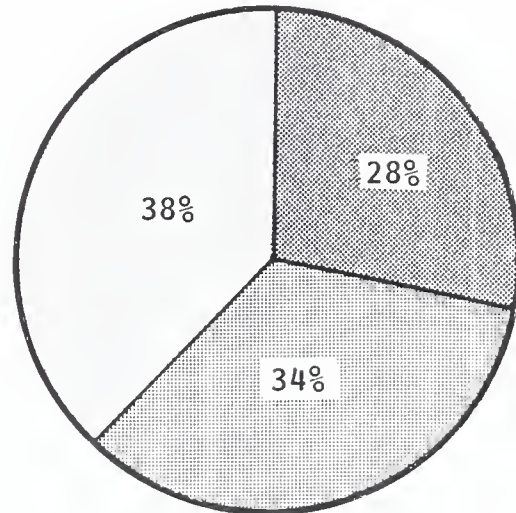
EXHIBIT II-2

USER REQUIREMENTS VERSUS SERVICES RECEIVED

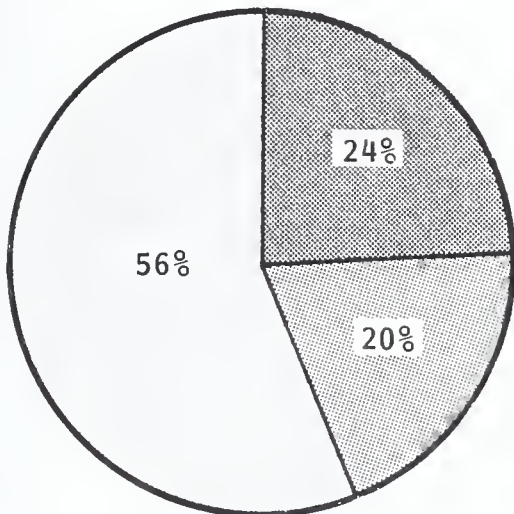
(Principal Services)



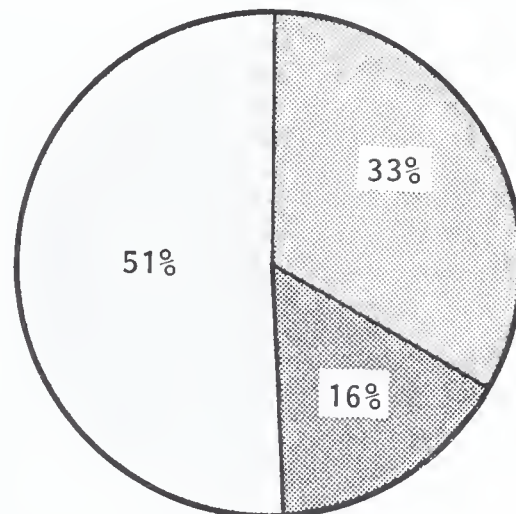
Hardware Maintenance



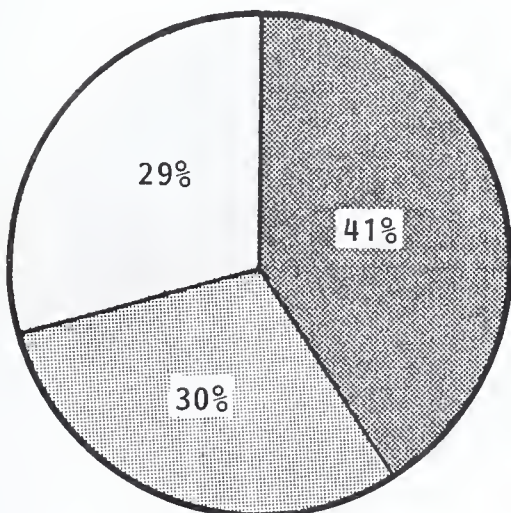
Software Maintenance



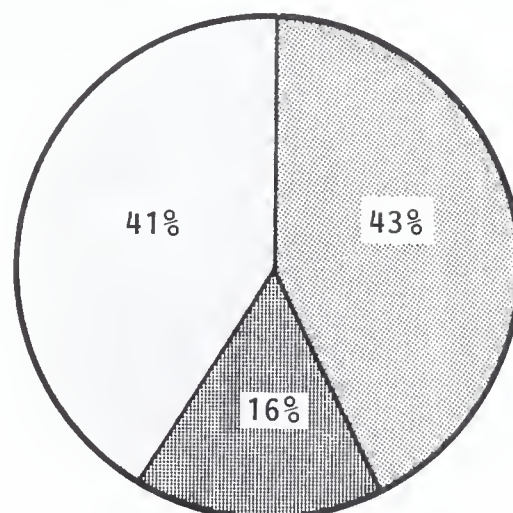
Relocation



Add-on Sales



Supply Sales



De-installation

□ Satisfied

▒ Dissatisfied

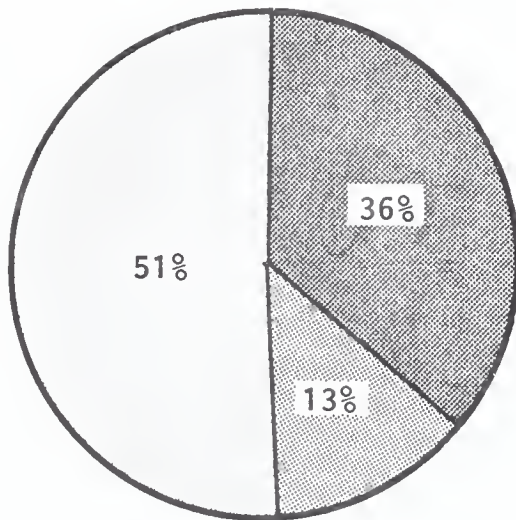
■ Overkill

(Continued)

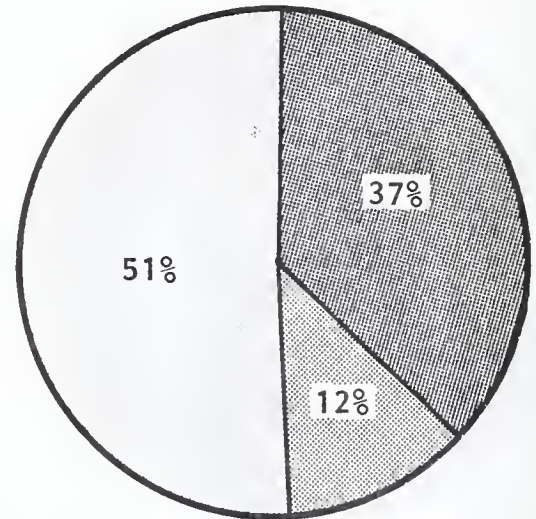
EXHIBIT II-2 (Cont.)

USER REQUIREMENTS VERSUS SERVICES RECEIVED

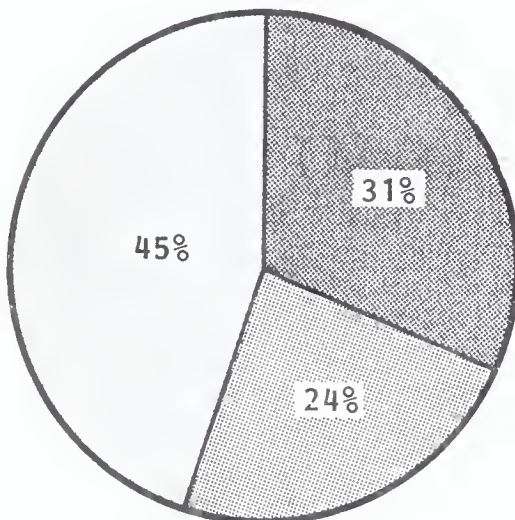
(Ancillary Services)



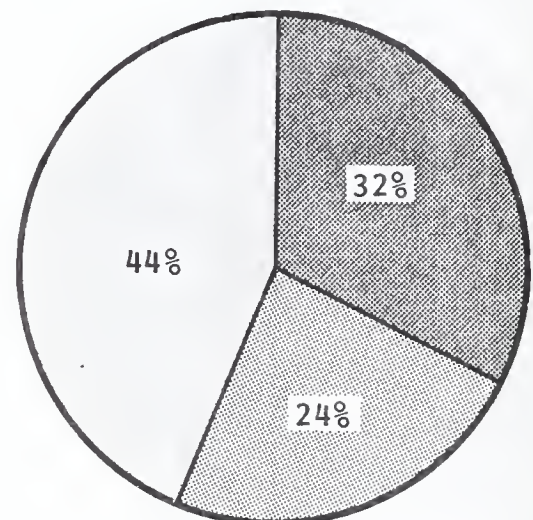
Environmental Planning



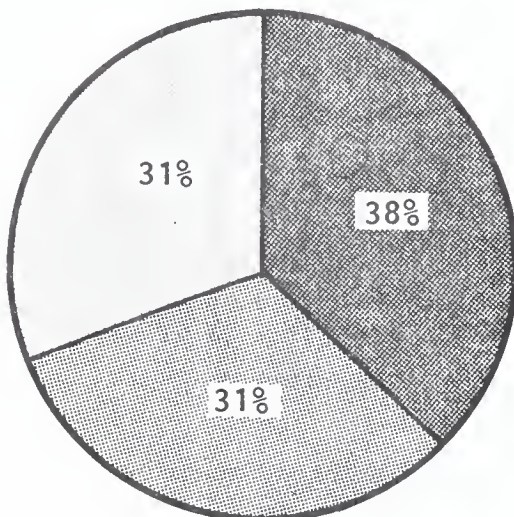
Physical Site Planning



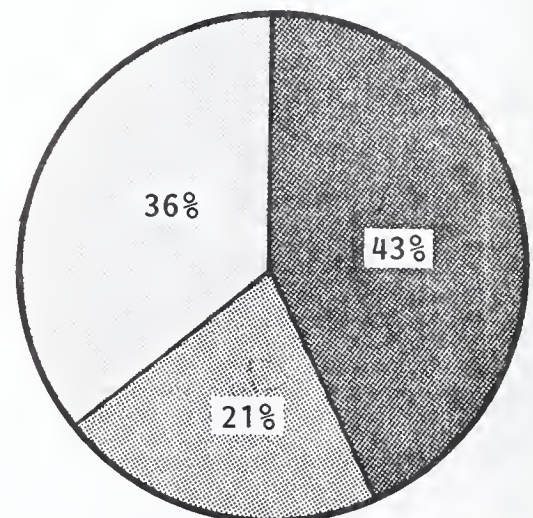
Consulting



Documentation



Training



Installation Planning



Satisfied



Dissatisfied

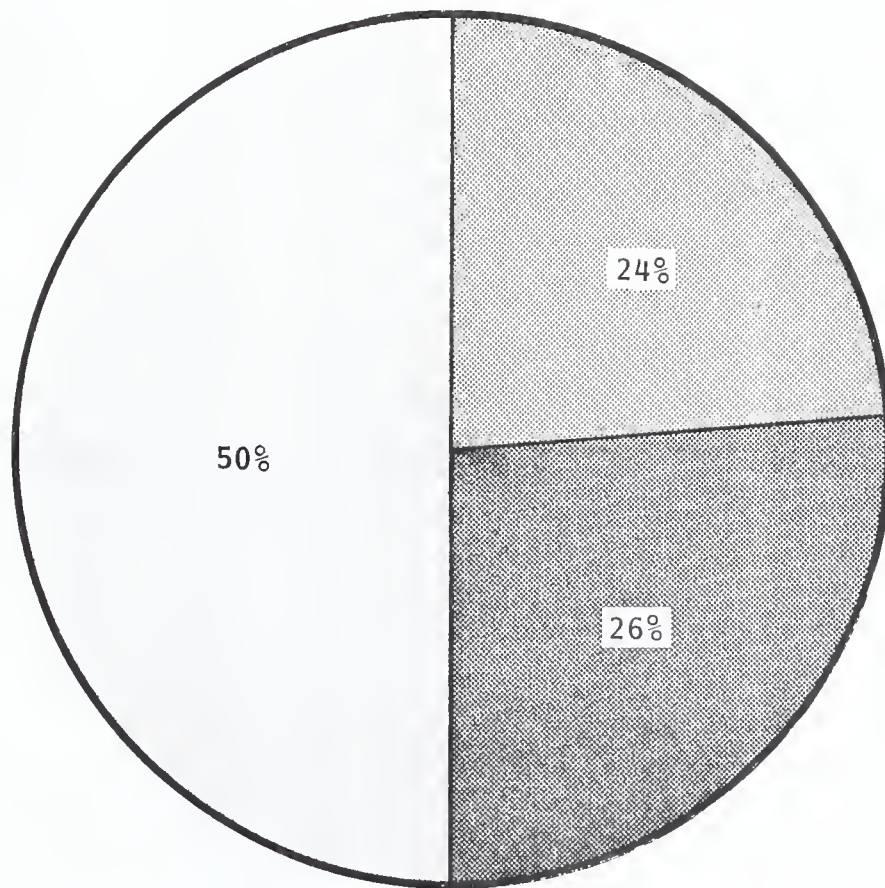


Overkill

(Continued)

EXHIBIT II-2 (Cont.)

USER REQUIREMENTS VERSUS SERVICES RECEIVED



Site Audits

☐ Satisfied ☐ Dissatisfied ☐ Overkill

EXHIBIT II-3
USER RATINGS OF VENDORS

VENDOR	USER RATINGS													
	Environmental Planning	Physical Site Planning	Consulting	Documentation	Training	Installation	Hardware Maintenance	Software Maintenance	Supplies Sales	Add-on Sales	Site Audits	Relocation	De-installation	Total Score (A=3, B=2, C=1, X=0)
CDC	A	A	A	B	A	A	B	A	X	A	X	A	A	31
Centronics	A	A	A	B	B	X	-	X	C	B	A	X	X	19
Decision Data	A	A	-	A	C	A	B	X	-	A	A	B	B	25
IBM	A	A	A	B	B	A	A	A	A	A	A	A	A	37
ITT	B	A	A	C	-	C	-	C	A	A	A	B	A	25
Memorex	B	A	B	A	-	B	C	C	B	A	B	A	A	27
Mohawk	A	A	A	B	A	A	A	C	A	A	A	A	B	35
NAS	A	A	C	A	C	A	C	-	B	A	B	A	B	27
STC/Documation	A	A	A	B	A	-	C	B	-	-	B	A	A	25
Telex	B	C	-	A	C	A	-	-	A	A	X	X	X	16
Xerox	A	A	A	A	C	B	-	-	C	A	A	B	B	26
Overall Service Scores	30	31	24	26	17	23	13	11	18	29	24	24	23	

A = 25% or less dissatisfied, and at least 50% satisfied
 B = 35% or less dissatisfied, and at least 40% satisfied
 C = 45% or less dissatisfied, and at least 30% satisfied

X = Insufficient or no responses - = All grades below A, B, and C

- Documentation scores are relatively high when compared with other products in the large- and small-system sectors; documentation was rated only average.
- Vendors surveyed have significantly higher scores in the peripheral and terminal product areas than they received in other sections of the industry tested. Even hardware maintenance showed a marginally better level of customer satisfaction.
- Individual user group requirements versus services provided are included in the after-sales support requirements. Due to the differences in service organization responsibilities, the results do not apply to some vendor service organizations as they are today, but apply more to the service provided by the company as a whole.
- Although overall ratings are very positive, several comments from the users surveyed showed serious concerns on their part about overall vendor attitudes toward responsiveness and training.
 - Several users felt FE knowledge on new equipment was inadequate; this made successful installation difficult.
 - Many vendors were criticized for lack of responsiveness, particularly in the software section of the survey.
 - Higher quality field engineers and more in-depth training were required by many users.
- The rating by users of vendors taking the initiative to improve user operations was low and should concern all vendors. The whole industry is doing poorly, not only in this particular survey, but in other INPUT surveys as well.

- Users are, at this time, fairly satisfied with services received; however, proposed new service methods could erode this. In the terminal area specifically, repair centers and support centers are meeting opposition from users. Comments of several vendors indicate a determination to make greater use of these services in the future. This could be a serious mistake and could allow the influx of third-party maintenance companies to escalate. Vendors are going to have to become very creative in their use of delivery services and scheduled maintenance. The user is the determining factor for the success of all vendors. At this time users seem generally agreeable to existing services, so intended changes in maintenance philosophies should be handled carefully.

E. SUMMARY AND RECOMMENDATIONS

- Two of the surveyed areas give a fairly good representation of the users' overall opinion of vendors. These surveyed areas are the users' ratings of vendors for overall service image and the vendors' general responsiveness. Ratings are shown in Exhibits II-4 and II-5 respectively.
 - The ratings for most vendors on overall service image is very good. Xerox must investigate the survey results to see if they can bring their results up to an acceptable level by using existing organizational structures. As new service methods are introduced, this overall high satisfaction level may become strained. Users have expressed opposition to any change in service methods. The challenge to provide both low cost of ownership and quality service will be difficult to meet. It is recommended that field service's role be expanded to include some sales activities and to complete maintenance contract responsibilities. The rapport that the hardware service personnel have with the users in their regular day-to-day dealings can be invaluable in attaining the aforementioned goals.

EXHIBIT II-4

USER RATINGS OF VENDORS FOR
OVERALL SERVICE IMAGE

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.7	1.8	8.0	8.0	302
CDC	8.0	1.5	8.0	9.0	20
Centronics	7.7	1.2	7.5	7.0	10
Decision Data	7.6	2.1	8.0	9.0	20
IBM	8.0	1.7	8.0	8.0	60
ITT	8.0	1.5	8.0	8.0	29
Memorex	7.4	2.1	8.0	9.0	44
Mohawk	8.0	1.8	8.5	9.0	20
NAS	8.0	1.3	8.0	8.0	21
STC/Documation	7.4	2.1	8.0	8.0	40
Telex	8.1	1.3	8.0	9.0	15
Xerox	6.6	1.8	7.0	7.0	20

EXHIBIT II-5

USER RATINGS OF VENDORS FOR GENERAL RESPONSIVENESS

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.8	1.8	8.0	8.0	302
CDC	8.5	1.2	8.5	7.0	20
Centronics	7.7	1.3	8.0	8.0	10
Decision Data	7.7	2.5	8.5	9.0	20
IBM	7.6	1.9	8.0	8.0	60
ITT	8.1	1.4	8.0	8.0	29
Memorex	7.3	2.3	8.0	9.0	44
Mohawk	7.6	2.1	8.0	9.0	20
NAS	8.6	1.5	9.0	9.0	21
STC/Documation	8.0	1.7	8.0	8.0	40
Telex	8.3	0.8	8.0	8.0	15
Xerox	7.0	1.5	7.0	7.0	20

- The users' view of the overall general responsiveness of peripheral and terminal vendors is excellent. Continued quality communications and a dedication to site management should ensure future success. The future resolution of telecommunications problems will be much more difficult, with vendors having to cooperate with users in an open manner. This will force many manufacturers to alter existing policies. If they do not, third-party organizations will prosper.

III AFTER-SALES SUPPORT REQUIREMENTS

III AFTER-SALES SUPPORT REQUIREMENTS

A. INTRODUCTION

- This section deals with the individual vendor results on after-sales support requirements. The users are split into three categories:
 - Those who require less than the average level of service provided (and who therefore experience service OVERKILL).
 - Those who require equal or greater levels of services than the average service level being provided, and get it (SATISFIED).
 - Those who require equal or greater levels of services than the average service level being provided, and receive less (DISSATISFIED).
- Each exhibit in this section also shows the average level of service required of the vendor by its particular users (for a given type of service), and the overall level received for that particular type of service.
- Due to several users' not responding to specific areas of the survey, care must be taken before making any definite conclusions. Also, user requirements are measured against the level of service being provided, so comparisons between vendors cannot be interpreted as absolutes. The charts do, however, show the strengths and weaknesses of each vendor.

- The term "overkill" is not necessarily a negative. It merely shows areas where resources can be effectively redirected. Some of these areas of overkill, such as consulting, may be intentional. Only the vendor can determine the definition of ideal allocation. INPUT defines ideal as less than 20% overkill, more than 50% satisfied, and less than 30% dissatisfied. Overall vendor results are shown in Exhibit III-1.

B. CDC USER REQUIREMENTS

- The average level of service provided is greater than required in every area surveyed. Users on the whole rate CDC service as very satisfactory.
- With respect to training and consulting, there are virtually no dissatisfied users, which is extremely rare within the computer industry.
- Although results from documentation and hardware maintenance show that some improvement is needed, levels of dissatisfaction are not critical.
- Exhibit III-2 gives a detailed summary of survey results.

C. CENTRONICS USER REQUIREMENTS

- Environmental planning, physical site planning, and consulting services are more than adequate. However, it appears that some of the resources should be applied to other areas.
- Hardware maintenance requires the most attention. The level of service provided needs improvement. Resources from the planning functions could be reapplied here.

EXHIBIT III-1

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED - ALL VENDORS

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.2	6.4	35.7%	51.2%	13.1%
Physical Site Planning	5.2	6.3	37.2	51.3	11.5
Consulting	5.4	6.1	31.6	44.5	23.9
Documentation	5.6	6.8	32.4	44.1	23.5
Training	6.4	6.3	37.7	31.5	30.8
Installation Planning	6.1	6.5	42.7	36.3	21.0
Hardware Maintenance	7.2	7.6	32.7	28.1	39.3
Software Maintenance	5.9	5.5	27.7	37.8	34.5
Supplies Sales	5.1	4.5	41.3	28.6	30.1
Add-on Sales	5.1	5.1	33.3	50.6	16.1
Site Audits	4.7	4.4	23.6	50.4	26.0
Relocation	5.6	6.0	23.8	56.1	20.1
De-Installation	5.2	5.8	42.6	41.4	16.0

 = Areas Requiring Attention

EXHIBIT III-2

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- CDC

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.0	8.1	35.7%	64.3%	0.0%
Physical Site Planning	5.3	8.1	30.0	70.0	0.0
Consulting	5.0	8.0	33.3	66.7	0.0
Documentation	5.5	7.7	46.2	23.1	30.7
Training	6.1	7.3	42.9	57.1	0.0
Installation Planning	4.6	7.6	46.2	38.4	15.4
Hardware Maintenance	6.9	7.5	35.0	35.0	30.0
Software Maintenance	3.8	5.7	30.0	60.0	10.0
Supplies Sales			Insufficient Response		
Add-on Sales	5.4	5.9	37.5	50.0	12.5
Site Audits			Insufficient Response		
Relocation	6.0	8.7	53.8	38.5	7.7
De-Installation	6.2	7.5	46.7	33.3	20.0

 = Areas Requiring Attention

- Other areas requiring attention are documentation, training, supplies sales, and add-on sales.
- As pointed out in Exhibit III-3, a redirection of resources should be considered.

D. DECISION DATA USER REQUIREMENTS

- Several areas require improvement, with consulting and supplies sales showing the most dissatisfaction. No user received more consulting services than required. Because of this, increases in resources may be needed to correct this deficiency.
- Add-on sales show virtually no dissatisfied users, but supplies sales has serious deficiencies. A better balance of sales support is needed.
- A significant number of users require more training support. Hardware maintenance shows some dissatisfaction, but not to the degree found in several other vendors surveyed.
- As shown in Exhibit III-4, decision data does a good job in most preinstallation activities.

E. IBM USER REQUIREMENTS

- Users are basically satisfied with all after-sales support services. Only in the area of training do services received trail services required. The number of users dissatisfied with training is relatively low, however.

EXHIBIT III-3

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED - CENTRONICS

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.3	4.5	50.0%	50.0%	0.0%
Physical Site Planning	2.3	4.5	50.0	50.0	0.0
Consulting	3.7	5.3	33.3	66.7	0.0
Documentation	6.5	6.5	22.2	44.5	33.3
Training	5.0	5.0	33.3	33.3	33.3
Installation Planning			Insufficient Response		
Hardware Maintenance	7.9	6.2	30.0	20.0	50.0
Software Maintenance			Insufficient Response		
Supplies Sales	5.9	3.9	25.0	37.5	37.5
Add-on Sales	3.8	3.8	33.3	33.3	33.3
Site Audits	5.0	3.5	25.0	50.0	25.0
Relocation			Insufficient Response		
De-Installation			Insufficient Response		

 = Areas Requiring Attention

EXHIBIT III-4

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED - DECISION DATA

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.3	4.6	50.0%	37.5%	12.5%
Physical Site Planning	3.6	4.0	40.0	60.0	0.0
Consulting	4.0	3.7	0.0	50.0	50.0
Documentation	5.1	6.0	41.7	33.3	25.0
Training	4.7	4.7	14.3	42.9	42.9
Installation Planning	4.4	4.6	20.0	80.0	0.0
Hardware Maintenance	6.4	7.4	35.0	30.0	35.0
Software Maintenance			Insufficient Data		
Supplies Sales	5.4	2.9	23.5	17.6	58.9
Add-on Sales	2.8	2.8	66.7	33.3	0.0
Site Audits	2.3	2.8	50.0	25.0	25.0
Relocation	4.2	3.3	50.0	16.7	33.3
De-Installation	3.7	4.2	33.3	33.3	33.3

= Areas Requiring Attention

- One surprise is the number of users requiring better documentation services. Although not serious, improvements would certainly be beneficial. Documentation is one of IBM's strong points, but finding out about documentation availability is not always easy.
- Both hardware and software maintenance received high ratings. IBM has involved field services in maintaining software for several years and this plan appears to be working very effectively.
- Exhibit III-5 provides the detailed user ratings for each service component.

F. ITT USER REQUIREMENTS

- The level of services provided is less than what is required in several critical areas. Hardware maintenance, software maintenance, and training are the most serious items needing improvement.
- Preinstallation services seem fairly sufficient, with supplies sales and add-on sales generally effective. ITT does a good job in the consulting area according to Exhibit III-6.
- With deficiencies in both training and documentation, user frustration could be affecting other ratings in the maintenance section of the survey. Both services should be reviewed, and increased resources provided in these areas.

G. MEMOREX USER REQUIREMENTS

- Training appears to be the service requiring most improvement according to Exhibit III-7. Fifty percent of users are dissatisfied, and the level of service provided trails requirements.

EXHIBIT III-5

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED

- IBM

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.9	7.2	21.1%	73.6%	5.3%
Physical Site Planning	6.1	7.4	35.9	59.0	5.1
Consulting	5.7	6.1	29.7	45.9	24.4
Documentation	6.5	6.8	37.7	28.3	34.0
Training	7.0	6.4	23.1	51.3	25.6
Installation Planning	6.4	7.1	32.4	61.8	5.8
Hardware Maintenance	6.7	7.7	30.5	47.5	22.0
Software Maintenance	6.6	7.0	26.7	48.9	24.4
Supplies Sales	3.7	4.3	41.7	38.9	19.4
Add-on Sales	5.1	5.4	31.4	51.4	17.2
Site Audits	4.4	4.6	38.2	53.0	8.8
Relocation	5.7	6.0	25.0	55.0	20.0
De-Installation	5.5	6.7	41.5	48.5	10.0

= Areas Requiring Attention

EXHIBIT III-6

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- ITT

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.5	6.4	36.4%	43.4%	18.2%
Physical Site Planning	5.9	5.8	35.7	42.8	21.4
Consulting	6.4	6.5	41.2	47.1	11.7
Documentation	7.0	7.0	33.3	29.6	37.0
Training	7.8	5.9	18.7	31.3	50.0
Installation Planning	7.6	6.2	28.5	35.7	35.7
Hardware Maintenance	8.5	8.0	23.3	26.7	50.0
Software Maintenance	8.1	6.7	18.2	36.4	45.5
Supplies Sales	5.8	5.9	25.0	58.3	16.7
Add-on Sales	5.8	5.9	22.2	66.7	11.1
Site Audits	5.8	4.8	8.3	75.0	16.6
Relocation	6.9	5.1	42.8	28.6	28.6
De-Installation	6.3	4.5	28.6	50.0	21.4

 = Areas Requiring Attention

EXHIBIT III-7

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- MEMOREX

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.3	6.7	27.6%	44.8%	27.6%
Physical Site Planning	5.4	6.4	25.0	55.0	20.0
Consulting	5.8	6.5	11.1	50.0	38.9
Documentation	5.9	7.3	30.3	45.5	24.2
Training	7.2	6.5	25.0	25.0	50.0
Installation Planning	6.4	6.6	26.3	47.4	26.3
Hardware Maintenance	7.1	7.7	31.8	25.0	43.2
Software Maintenance	5.8	4.7	38.5	23.0	38.5
Supplies Sales	5.2	5.6	23.1	46.1	30.8
Add-on Sales	5.6	5.5	16.7	61.1	22.2
Site Audits	5.3	5.3	16.7	55.5	27.8
Relocation	5.2	6.4	15.8	73.7	10.5
De-Installation	5.9	6.5	16.7	72.3	11.1

 = Areas Requiring Attention

- Hardware maintenance, software maintenance, and consulting are also significant areas of concern.
- Overall, ratings are fairly typical in most other areas. Levels of service equal or exceed requirements.

H. MOHAWK USER REQUIREMENTS

- Mohawk users gave high ratings to most after-sales support services. Several items surveyed showed little or no dissatisfaction.
- According to Exhibit III-8, only software maintenance and de-installation services lagged behind requirements. Neither of these appears to be critical.
- There are several instances of overkill where resources could be redirected to other areas. The excellent job done during preinstallation carries through to all areas.

I. NAS USER REQUIREMENTS

- The software maintenance area shows a surprising number of dissatisfied users according to Exhibit III-9. A company with products that span the systems sector should receive higher ratings.
- Consulting, hardware maintenance, and user training also need attention. These items are not as critical as software maintenance, however, and the level of services provided is close to requirements.

EXHIBIT III-8

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- MOHAWK

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.0	5.7	42.9%	57.1%	0.0%
Physical Site Planning	2.5	4.3	50.0	50.0	0.0
Consulting	4.3	6.2	45.5	45.5	9.0
Documentation	6.4	6.8	33.3	38.9	27.8
Training	5.4	6.6	42.9	42.9	14.2
Installation Planning	4.9	6.7	28.6	71.4	0.0
Hardware Maintenance	6.1	7.7	50.0	30.0	20.0
Software Maintenance	6.8	5.7	27.2	36.4	36.4
Supplies Sales	2.1	2.3	28.6	71.4	0.0
Add-on Sales	3.9	4.8	50.0	50.0	0.0
Site Audits	1.5	1.7	33.3	66.7	0.0
Relocation	4.6	4.7	44.4	55.6	0.0
De-Installation	5.7	5.3	30.0	40.0	30.0

= Areas Requiring Attention

EXHIBIT III-9

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED - NAS

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.2	6.0	33.3%	50.0%	16.7%
Physical Site Planning	5.2	6.3	35.3	47.1	17.6
Consulting	6.0	5.9	14.3	42.8	42.9
Documentation	6.4	8.6	47.1	29.4	23.5
Training	6.0	6.7	25.0	37.5	37.5
Installation Planning	6.2	6.8	47.4	31.6	21.0
Hardware Maintenance	8.7	8.6	23.8	33.3	42.9
Software Maintenance	6.4	5.7	13.3	26.7	60.0
Supplies Sales	4.9	4.8	18.2	54.5	27.3
Add-on Sales	4.8	5.5	46.2	30.7	23.1
Site Audits	4.9	4.9	14.3	57.1	28.6
Relocation	5.2	6.5	17.6	58.8	23.5
De-Installation	5.3	5.8	14.3	57.1	28.6

 = Areas Requiring Attention

- Documentation receives high ratings when compared to the rest of the industry. Other services are rated fairly typically.

J. STC USER REQUIREMENTS

- Interestingly, according to Exhibit III-10, STC hardware maintenance shows a higher level of user dissatisfaction than software maintenance. This is typical of the industry.
- Installation planning is also a concern expressed by users. (On the other hand, the level of service received for installation planning exceeds user requirements.) Comparing installation planning with the relative satisfaction of other planning areas may be revealing. It may point out a management problem in field service. Before any conclusions can be made, overall survey results must be studied.
- Add-on sales and supplies sales are clear areas of opportunity for increased revenues.

K. TELEX USER REQUIREMENTS

- Judging from Exhibit III-11, Telex management has several areas requiring attention. The most serious of these are hardware and software maintenance. The results shown tend to indicate a need for increased resources and redirection of priorities in these areas.
- Consulting, training, and physical site planning are the other areas showing significant user dissatisfaction. Documentation seems to be more than adequate.

EXHIBIT III-10

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- STC

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	4.8	7.1	50.0%	37.5%	12.5%
Physical Site Planning	4.8	6.5	46.1	30.8	23.1
Consulting	3.9	6.4	46.7	46.7	6.7
Documentation	4.8	6.5	43.7	28.1	28.1
Training	4.9	6.9	46.7	33.3	20.0
Installation Planning	6.2	6.6	30.0	20.0	50.0
Hardware Maintenance	6.5	7.6	32.5	22.5	45.0
Software Maintenance	5.2	6.2	33.3	33.3	33.3
Supplies Sales	4.6	4.0	23.1	23.1	53.8
Add-on Sales	5.1	4.0	33.3	11.1	55.6
Site Audits	4.9	4.9	33.3	33.3	33.3
Relocation	5.8	7.2	52.0	36.0	12.0
De-Installation	6.1	7.3	53.3	26.7	20.0

 = Areas Requiring Attention

EXHIBIT III-11

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- TELEX

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	3.1	3.4	28.5%	42.8%	28.5%
Physical Site Planning	3.2	3.4	20.0	40.0	40.0
Consulting	5.3	4.3	0.0	50.0	50.0
Documentation	5.5	6.4	41.7	41.7	16.6
Training	5.0	4.0	20.0	40.0	40.0
Installation Planning	5.2	5.0	20.0	60.0	20.0
Hardware Maintenance	6.9	6.7	33.3	13.3	53.3
Software Maintenance	4.6	3.0	33.3	0.0	66.7
Supplies Sales	3.4	3.2	40.0	40.0	20.0
Add-on Sales	4.6	3.8	40.0	40.0	20.0
Site Audits			Insufficient Data		
Relocation			Insufficient Data		
De-Installation			Insufficient Data		

= Areas Requiring Attention

- Some areas, such as relocation, received insufficient responses to determine their effectiveness. In general, Telex may need increased field resources to raise customer satisfaction in the peripheral/terminal sectors of the industry.

L. XEROX USER REQUIREMENTS

- According to Exhibit III-12, hardware and software maintenance is the issue concerning Xerox users. Fifty percent or more are dissatisfied with the level of services provided.
- Several users expressed dissatisfaction with user training. This is surprising, considering Xerox's long time in the business and overall philosophy. Dissatisfaction may be confined to only this portion of the business, however.
- Most other areas received ratings typical for the rest of the vendor community. Xerox's efforts appear to be more evenly balanced than most, with little overkill.

EXHIBIT III-12

USER SERVICE REQUIREMENTS VERSUS LEVEL OF SERVICE RECEIVED
- XEROX

TYPE OF SERVICE PROVIDED	AVERAGE LEVEL OF SERVICE		PERCENT OF USERS REQUIRING		
	REQUIRED	RECEIVED	Less than Average Level of Service Provided (OVERKILL)	Equal or Greater than Average Level of Service and Get It (SATISFIED)	Equal or Greater than Average Level of Service and Receive Less (DISSATISFIED)
Environmental Planning	5.5	6.2	38.5%	46.1%	15.4%
Physical Site Planning	5.4	6.3	33.3	58.4	8.3
Consulting	5.6	6.3	28.6	50.0	21.4
Documentation	5.8	6.8	31.6	47.3	21.1
Training	7.6	6.3	18.8	37.4	43.8
Installation Planning	6.1	6.2	30.0	40.0	30.0
Hardware Maintenance	8.3	6.8	15.0	30.0	55.0
Software Maintenance	7.9	6.5	25.0	25.0	50.0
Supplies Sales	7.1	5.9	25.0	37.5	37.5
Add-on Sales	6.4	5.4	30.0	50.0	20.0
Site Audits	5.1	4.0	33.3	44.5	22.2
Relocation	4.9	4.5	27.3	45.5	27.3
De-Installation	4.3	3.6	27.3	45.5	27.3

 = Areas Requiring Attention

IV MAINTENANCE REQUIREMENTS

IV MAINTENANCE REQUIREMENTS

A. SYSTEM OR PRODUCT AVAILABILITY

- Equipment availability varies by both product type and user configuration. NAS and CDC are the two vendors surveyed that have the highest user requirement for availability. Those with the lowest are Centronics and Mo-hawk. CDC, according to Exhibit IV-1, provides the highest product availability of all those surveyed.
 - The mean overall (actual) availability of 94.8% is equal to users' requirements. Of 11 vendors surveyed, only 5 exceeded user needs.
 - When surveyed for availability during critical periods, the results are similar to those found in the system surveys.
 - In the future, availability will become more critical as product usage and dependence increase. As peripheral products become more accessible through the use of new communication methods, activity on this equipment will increase. For those users large enough to maintain additional disk space, terminals, and printers, requirements will remain stable. Those with limited resources will be more demanding.
 - Today many system manufacturers are developing fault tolerant systems using mirror image I/O devices. This relieves some pressure on

EXHIBIT IV-1

USER REQUIREMENTS FOR EQUIPMENT AVAILABILITY (Percent Uptime)

VENDOR	AVAILABILITY (MEAN)		
	OVERALL REQUIRED	OVERALL ACTUAL	CRITICAL PERIOD REQUIRED
All Vendors	94.6%	94.8%	97.5%
CDC	97.3	98.2	98.6
Centronics	92.0	95.3	96.3
Decision Data	93.9	92.2	96.5
IBM	94.6	95.3	96.4
ITT	93.2	95.0	96.2
Memorex	95.2	94.3	98.8
Mohawk	92.9	96.1	96.8
NAS	98.2	97.2	98.8
STC/Documation	93.7	93.1	98.6
Telex	95.7	95.6	97.9
Xerox	94.7	92.5	97.4

systems but does little for peripheral maintenance. The cost factor for duplicating I/O is in many cases prohibitive.

B. DELIVERY MODES

- One fact is obvious throughout the survey: users are not going to easily and quickly accept new service methods, such as repair and support centers. Vendors are going to have to become very creative in their use of delivery services and scheduled maintenance. The user wants reduced maintenance costs but an increased level of service. Some vendors are risking their own future profits by offering unrealistic maintenance contracts.
- Based on Exhibits IV-2 and IV-3, users ranked their preferences as follows (most favored listed first):
 - Hardware.
 - Traditional on-site response.
 - Customer doing problem determination with support center.
 - Customer doing problem determination without center.
 - Customer replacing components.
 - On-site standby during critical periods.
 - Delivering modules to repair centers.
 - Software.

EXHIBIT IV-2

USER RATINGS OF METHODS OF HARDWARE MAINTENANCE

VENDOR	HARDWARE					
	Traditional On-site Response	Customer Working Without Remote Center	Customer Working With Remote Center	Customer Replacing Components	Delivering Modules to Repair Center	On-site Stand by During Critical Periods
All Vendors	8.3	5.8	6.0	4.6	3.4	4.2
CDC	7.5	5.4	5.5	4.7	3.0	3.8
Centronics	8.9	4.5	5.2	3.0	2.8	2.3
Decision Data	8.5	4.8	5.5	5.1	3.3	2.4
IBM	7.7	6.1	5.7	3.4	3.0	5.5
ITT	8.3	5.9	6.3	5.2	3.5	4.1
Memorex	8.0	5.9	5.6	4.4	3.9	4.6
Mohawk	8.5	6.1	4.8	4.3	3.4	3.6
NAS	8.9	5.2	6.6	4.0	3.5	6.2
STC/Documation	8.4	5.4	5.5	5.3	3.9	3.2
Telex	8.4	4.4	5.6	6.3	4.6	3.2
Xerox	6.9	5.4	5.6	3.0	2.2	3.9

EXHIBIT IV-3

USER RATINGS OF
METHODS OF SOFTWARE MAINTENANCE

VENDOR	SOFTWARE					
	Traditional On-site Response	Customer Working Without Remote Center	Customer Working With Remote Center	Customer Replacing Components or Program Fixes	Delivering Modules to Repair Center	On-site Stand by During Critical Periods
All Vendors	8.1	6.0	6.2	4.8	3.6	4.4
CDC	8.5	6.1	5.9	4.4	3.0	3.8
Centronics	7.9	4.0	5.0	2.9	2.7	2.2
Decision Data	8.5	4.7	5.3	5.0	3.2	5.3
IBM	7.0	5.8	5.8	4.6	2.9	5.1
ITT	8.5	6.5	7.0	5.0	3.0	4.0
Memorex	7.3	6.2	5.6	4.7	3.8	4.4
Mohawk	8.4	6.2	4.9	4.3	3.6	3.6
NAS	8.5	5.2	6.6	4.0	3.3	5.9
STC/Documation	8.2	6.1	5.8	4.6	3.9	3.2
Telex	6.3	3.8	4.7	6.0	3.6	2.3
Xerox	8.0	6.0	6.5	3.0	2.0	5.0

- . Traditional on-site response.
 - . Customer working with support center.
 - . Customer working without support center.
 - . Customer installing program fixes.
 - . On-site standby during critical periods.
 - . Delivery of modules to repair center.
- User involvement in making hardware repairs will be delayed significantly because of their reluctance to participate in maintaining equipment. This will force vendors to maintain fairly large field service groups.

C. **HARDWARE AND SOFTWARE RESPONSIVENESS**

- Responsiveness can be defined as being more than a reaction to machine-down situations. Vendor attitude, meeting commitments, or (as some users commented) failure to accept a problem as their own, determine overall responsiveness. As equipment becomes more integrated with other vendors' products, opportunities for third-party maintenance companies will become even more prevalent unless vendors change their attitude.
- The overall response time to hardware problems by vendors matched or bettered user requirements. Details are shown in Exhibit IV-4. Also, these requirements varied significantly by product type.
- The software response section of the survey was more critical. Only three vendors matched user requirements in Exhibit IV-5. Overall, the mean aver-

EXHIBIT IV-4

USER RATINGS OF
HARDWARE RESPONSE AND REPAIR TIME
(hours)

VENDOR	MEAN			MEDIAN		
	Repair Time	Required Response	Average Response	Repair Time	Required Response	Average Response
All Vendors	3.5	2.8	2.7	2.0	2.0	1.5
CDC	1.6	1.4	1.1	1.5	1.0	1.0
Centronics	9.2	7.0	7.8	2.0	8.0	5.5
Decision Data	2.1	3.6	4.3	1.0	2.0	2.0
IBM	3.6	1.6	1.7	1.5	1.0	1.0
ITT	1.8	3.1	2.8	1.0	2.0	1.0
Memorex	6.8	3.9	3.6	2.0	2.0	2.0
Mohawk	2.1	3.7	2.8	2.0	2.8	2.0
NAS	1.8	1.2	0.9	1.0	1.0	1.0
STC/Documation	2.2	1.7	1.4	2.0	2.0	1.0
Telex	5.8	7.1	6.7	2.0	4.0	2.5
Xerox	2.3	1.4	1.6	2.0	1.5	1.3

EXHIBIT IV-5

USER RATINGS OF SOFTWARE RESPONSE AND MAINTENANCE (hours)

VENDOR	SYSTEM INOPERABLE		SYSTEM SIGNIFICANTLY DEGRADED		SYSTEM CIRCUMVENTED BUT DEGRADED	
	Required Response	Actual Response	Required Response	Actual Response	Required Response	Actual Response
All Vendors	2.5	3.5	6.0	7.2	26.8	27.0
CDC	1.5	1.1	1.5	1.2	14.3	14.8
Centronics			Not Significant			
Decision Data			Not Significant			
IBM	2.5	2.8	10.9	11.9	43.6	43.5
ITT	1.5	1.2	2.7	2.8	3.8	4.2
Memorex	0.9	1.6	8.0	4.0	24.6	21.4
Mohawk	3.0	2.7	13.8	13.8	21.3	18.0
NAS	0.6	1.0	0.6	1.0	12.7	12.8
STC/Documation	4.0	5.0	4.5	4.0	4.5	4.0
Telex			No Entry			
Xerox	5.6	10.3	3.7	7.6	31.1	33.1

age response time was one hour more than users felt they needed. Comments from the survey show real dissatisfaction from some users; they requested more openness and cooperation from vendors.

- Throughout the survey, however, some isolated references were made about improving vendor responsiveness. Although aimed at specific vendors, they do not show up in Exhibit IV-5 which gives a picture of good overall responsiveness.

D. EQUIPMENT REPAIR

- Up to this point we have been discussing the users' views on responsiveness, product availability, and the different modes of making repairs. We are now going to examine the users' opinion of the vendors' ability to make quality repairs on both hardware and software. Prior to examining specific survey questions, several user comments should be reviewed. Although some are aimed at specific vendors, many apply to all:
 - New product training is inadequate, resulting in difficult installations.
 - A higher quality person is required and more in-depth training is needed for field engineers.
 - For greater availability, increase the size of field engineering groups.
 - More openness and fairness is required on the part of field service and software support groups.
- Again, these are not INPUT's comments but user comments.

1. HARDWARE MAINTENANCE

- Users seem generally satisfied with most vendors' ability to diagnose and effectively repair hardware problems. The above comments are not reflected in the overall ratings. Only one vendor, Xerox, received a rating of less than 7.0 - that was 6.9. The results in Exhibit IV-6 show NAS with the highest rating and ITT and IBM close behind.

2. SOFTWARE MAINTENANCE

- A survey question about the ability to maintain software only received half as many responses as did a similar hardware question. Software results are significantly lower overall, with Telex doing significantly better than most. On the other hand, Exhibit IV-7 shows that Telex received only four responses; thus each vendor must analyze its results based on the number of responses. For several vendors, other INPUT survey results should give a better overall picture of their performance.
- Although the industry is beginning to see an influx of computer programmers, their skills are being used in development and application-oriented areas. Field engineers in the peripheral and terminal sector can be used to maintain system software because it is now being relied upon in the large-system area.

3. REPAIR TIME

- If the mean average repair time in Exhibit IV-4 (3.5 hours) is accurate, it is suprisingly high. Using this repair time, a field engineer can only handle two calls a day. Using \$60 to \$100 as an hourly burdened rate for a field engineer, the average cost per call is \$210 to \$350. Also, if technical people take this long, users doing their own maintenance will experience real difficulty.

EXHIBIT IV-6

USER RATINGS OF VENDORS' ABILITY TO DIAGNOSE HARDWARE PROBLEMS AND MAKE REPAIRS

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.5	1.8	8.0	8.0	302
CDC	7.5	1.9	8.0	9.0	20
Centronics	7.4	1.9	8.0	5.0	10
Decision Data	7.5	2.3	8.0	8.0	20
IBM	7.9	1.5	8.0	8.0	60
ITT	8.1	1.2	8.0	8.0	29
Memorex	7.2	1.9	7.0	7.0	44
Mohawk	7.5	2.3	8.0	8.0	20
NAS	8.3	1.7	9.0	9.0	21
STC/Documation	7.1	2.1	8.0	8.0	40
Telex	7.2	1.9	9.0	9.0	15
Xerox	6.9	1.8	7.5	8.0	20

EXHIBIT IV-7

USER RATINGS OF VENDORS' ABILITY TO MAINTAIN SOFTWARE

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	6.9	1.9	7.0	7.0	154
CDC	7.1	1.2	7.0	7.0	19
Centronics	Insignificant				2
Decision Data	7.3	2.5	5.0	6.0	3
IBM	7.0	2.0	7.0	7.0	44
ITT	7.3	1.6	8.0	8.0	13
Memorex	5.8	1.7	6.0	7.0	13
Mohawk	6.3	2.6	5.5	7.0	14
NAS	6.8	2.1	7.5	7.5	10
STC/Documation	6.9	1.6	6.0	6.0	15
Telex	8.0	1.4	8.5	8.0	4
Xerox	6.5	1.9	6.0	7.0	17

E. SITE MANAGEMENT

- In the past, vendors committed a significant amount of resources to the nontechnical areas of the field engineering function. Nontechnical training was part of their basic training. Territory management time influenced manpower planning projections. Today most companies use just technical items when building a planning model. This hinders the field engineer from participating significantly in user consultation.
- Due to product specialization within field service and the mixed vendor shop environment, users lost a central contact with the vendor organization. The impact this has on future sales opportunities is difficult to measure, but is a factor. One reason users consider using third-party maintenance is that there is a common source of contact with those who repair equipment. Responses to several questions in the survey indicate that users are requesting more interest on the part of vendors in improving a user's operation. Exhibit IV-8 shows the vendors' effectiveness in taking this initiative.
- By using field engineering in a total service concept, account responsibility would be centralized. While this is difficult when dealing only with peripherals, it is a method of expressing an interest in the user's business. The tracking of equipment performance and overall account reliability will pay dividends in the future. The software support area, although important but not critical to peripheral users, would be improved to acceptable service levels.
- Site management training must be increased throughout the industry. What seems like common sense has been the result of customer relations training as well as field experience.

EXHIBIT IV-8

USER RATINGS OF VENDORS WITH RESPECT TO TAKING THE INITIATIVE TO IMPROVE USER OPERATIONS

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	6.4	2.2	7.0	7.0	283
CDC	7.0	1.3	7.0	7.0	17
Centronics	6.7	2.4	8.0	8.0	9
Decision Data	5.2	2.5	5.0	6.0	17
IBM	6.8	2.3	7.0	7.0	58
ITT	6.5	1.7	6.0	6.0	27
Memorex	6.4	2.4	7.0	8.0	42
Mohawk	6.2	2.6	5.5	6.0	14
NAS	6.8	1.9	8.0	8.0	21
STC/Documation	6.3	2.2	7.0	7.0	36
Telex	6.4	2.5	7.0	5.0	15
Xerox	5.5	1.5	6.0	6.0	19

- For an industry whose products continue to promise increased productivity, the responses in Exhibit IV-8 are surprising. Unless vendors work with the customer base and assist them to improve their operations, future sales may be difficult. Programs such as consulting must be expanded and must use field engineering as a resource.

F. SERVICE OPPORTUNITIES FOR VENDORS

- Communications media will be changing drastically over the next few years. Ethernet, satellite communications, and other networking applications will require new products within the network itself. Repeaters, PLAs, and other devices will require both knowledge of new test equipment use and the development of different diagnostic methods. Users will be forced to decide whether to form in-house maintenance groups or rely on those vendors supplying the support products. Corporations whose main products are terminals and printer equipment can expand their services by aggressively pursuing this sector of the business. It could have a very positive influence on increasing future product sales.
 - Software maintenance could be effectively supported by field service. Overall customer satisfaction could be improved, as well as user communications.
 - Field service should be used in the design of new products. Many organizations have moved in this direction with positive results. Products developed with maintainability in mind eventually lower the overall cost of user ownership. Investments in field service by vendors in the development stage pay dividends. Also, user comments that new products are being inadequately supported would be eliminated.

- Flexibility of maintenance contracts could increase overall field service revenues. Variable shift coverage and other options should be investigated, with customer contracts being considered. Although difficult to administer, in the future user requirements will dictate flexibility.
- Terminal maintenance provides the user with several maintenance contract options - service centers, scheduled maintenance, user sparing, and traditional maintenance. Vendors should provide a large variety of plans.

G. THIRD-PARTY MAINTENANCE REQUIREMENTS

- An average of 31% of users are employing third-party maintenance today. According to Exhibit IV-9, peripherals and terminals are becoming main targets of TPM companies because of the high volumes involved. Also, many vendors employ third-party maintenance instead of creating a service organization.
- With an average of 38% of users contemplating the use of third-party maintenance, it appears that several corporations will find themselves with diminishing field service revenues.
- The use of third-party maintenance companies has, other than loss of revenues, several other detrimental effects on vendors - the control of engineering change activity and firmware updates in the field can no longer be managed efficiently. Another result is the integration of other vendors' products, which may seriously affect a products' performance. But the loss of account management is the most serious effect. A vendor must weigh third-party maintenance companies and may come to the realization that cooperation is the only sensible approach.

EXHIBIT IV-9

USER RATINGS OF
SINGLE-SOURCE AND THIRD-PARTY MAINTENANCE

VENDOR	SINGLE SOURCE	THIRD-PARTY MAINTENANCE		OTHER
	Importance Of Single- Source Maintenance (1-10)	Percent of Users Employing TPM	Percent of Users Considering TPM	Percent of Users Considering Maintenance Management Contracts
All Vendors	7.1%	31.0%	38.0%	30.0%
CDC	4.5	55.0	25.0	25.0
Centronics	5.5	70.0	40.0	30.0
Decision Data	6.9	30.0	35.0	30.0
IBM	7.9	28.3	56.7	38.3
ITT	7.3	26.7	26.7	20.0
Memorex	7.0	27.3	54.5	36.4
Mohawk	8.3	10.0	10.0	20.0
NAS	7.6	42.9	14.3	4.8
STC/Documation	6.1	27.5	35.0	45.0
Telex	7.3	33.3	53.3	26.7
Xerox	8.2	25.0	30.0	30.0

- Vendors may decide to use TPM for providing service in remote locations. This has allowed several vendors to market products in previously unsupported cities. It has proved successful when administered by management that is dedicated to that function. This activity will continue to become more accepted in the future.
- Thirty percent of users are considering the use of maintenance management contracts. This figure is higher than previously experienced, but with the aforementioned future communication maintenance requirements, it is not surprising. Vendors should aggressively pursue this opportunity.

V COMMUNICATION REQUIREMENTS

V COMMUNICATION REQUIREMENTS

A. INTRODUCTION

- This section will encompass several areas that show the true nature of the vendor. Communications is an art form, and has the power to incite or comfort. A field engineer that is talented in dealing with customers can maintain stability during difficult periods. Poor communications can make situations worse than they really are. Several communication areas were surveyed, including invoicing and dispatching. The survey gives a good picture of the users' attitudes at this time.

B. SERVICE MANAGEMENT COMMUNICATIONS

- User ratings vary greatly, with NAS having the highest. Management communications are the key to successfully maintaining a satisfied customer base. Any score that is less than the average mean needs investigation. Field management must maintain high quality and frequent customer communications.
- Interestingly, Exhibits V-1 and V-2 show that hardware service engineers rate higher than management in most cases.

EXHIBIT V-1

USER RATINGS OF VENDORS FOR SERVICE MANAGEMENT COMMUNICATION

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.3	1.8	8.0	8.0	287
CDC	7.4	1.5	7.5	8.0	19
Centronics	7.1	1.5	7.0	7.0	9
Decision Data	6.8	1.9	7.0	8.0	20
IBM	7.5	1.8	8.0	8.0	56
ITT	7.7	1.5	8.0	8.0	28
Memorex	7.2	1.8	8.0	8.0	40
Mohawk	7.4	2.0	8.0	8.0	19
NAS	8.0	1.4	8.0	7.0	21
STC/Documation	7.0	1.6	7.0	8.0	38
Telex	7.8	2.0	8.0	8.0	15
Xerox	6.7	2.1	7.0	7.0	20

EXHIBIT V-2

USER RATINGS OF VENDORS FOR HARDWARE SERVICE ENGINEERS' COMMUNICATION

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.7	1.6	8.0	8.0	302
CDC	7.8	1.5	8.0	8.0	20
Centronics	7.4	1.9	7.5	5.0	10
Decision Data	7.4	1.8	8.0	8.0	20
IBM	8.2	1.2	8.0	8.0	60
ITT	8.1	1.1	8.0	8.0	29
Memorex	7.3	1.7	8.0	8.0	44
Mohawk	7.9	1.9	8.0	10.0	20
NAS	8.3	1.4	9.0	9.0	21
STC/Documation	7.3	1.8	8.0	8.0	40
Telex	8.1	1.5	9.0	9.0	15
Xerox	6.9	1.6	7.0	7.0	20

- Xerox and Decision Data need to concentrate on improving their results. Communication problems tend to affect other areas of the survey.

C. HARDWARE SERVICE ENGINEERS' COMMUNICATIONS

- Judging from the results shown in Exhibit V-2, most vendors do a good job. NAS and IBM appear to have very effective programs, as do several others. Xerox results are similar to those shown in management communications. A concentrated effort to improve those results should be one of Xerox's goals.
- In the past, service organizations spent considerable time and resources developing customer relations programs. Today most programs are aimed at the technical portion of the field engineer's job. Every company in the systems business should invest in the nontechnical portions of the FE's job. As they have for IBM, the nontechnical aspects of the FE's job will pay dividends in the future.

D. SOFTWARE SERVICE ENGINEERS' COMMUNICATIONS

- Ratings of software service engineers' communications are significantly lower than those for hardware engineers. This could be because of available resources or lack of responsiveness. This trend is common throughout the industry and needs to be corrected. As shown in Exhibit V-3, Telex and ITT do a good job, but Memorex needs improvement.

EXHIBIT V-3

USER RATINGS OF VENDORS FOR SOFTWARE SERVICE ENGINEERS' COMMUNICATIONS

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	6.7	2.0	7.0	7.0	158
CDC	7.1	1.4	7.0	7.0	8
Centronics		Insignificant			2
Decision Data	6.7	1.5	7.0	7.0	3
IBM	7.2	1.8	7.0	7.0	47
ITT	7.6	1.7	8.0	8.0	14
Memorex	5.5	1.8	5.0	4.0	13
Mohawk	6.3	2.0	6.5	7.0	16
NAS	6.7	2.7	8.0	8.0	13
STC/Documation	6.3	2.3	6.5	6.0	18
Telex	8.0	1.8	8.0	8.0	4
Xerox	6.7	2.0	7.0	7.0	17

E. MARKETING SERVICES TO END USERS

- In most vendor organizations maintenance contracts are marketed through the sales organizations. This worked very well when maintenance was a non-competitive environment and contracts were basically standard. Unfortunately, many special contracts were signed that had a serious impact on future revenues. Some of these negated the profit margins that should have been realized.
- In today's environment, with users favoring unbundling of maintenance requirements, as shown in Exhibit V-4, field service must be given the sales responsibility for maintenance contracts. As special or custom contracts become more commonplace, field service managers must have the authority to assure the vendor organizations that expected revenues will be received and users' needs met. This is not an easy task, but one that most field organizations are ready to handle.
- Many of the after-sales support services discussed earlier should be the responsibility of field service management. The merging of software and hardware maintenance into one contract will enhance maintenance sales and provide the user with a complete maintenance package that is provided through a single department.

F. USER RECEPTIVITY TO ENGINEERS THAT SELL

- Judging from the overall vendor responses to field engineers in a sales role, users are generally favorable to the idea in all areas except supplies sales and software packages. Details are shown in Exhibit V-5. When putting together a program for sales by field engineering, care must be taken to ensure that the engineers' main performance reviews are centered around equipment

EXHIBIT V-4

USER RESPONSES TO THE QUESTION OF MAINTENANCE REQUIREMENTS UNBUNDLING

VENDOR	HARDWARE			SOFTWARE		
	Favor	Neutral	Oppose	Favor	Neutral	Oppose
All Vendors	58%	14%	28%	57%	16%	27%
CDC	60	20	20	60	20	20
Centronics	90	-	10	-	-	-
Decision Data	55	5	40	55	5	40
IBM	53	7	40	50	12	38
ITT	43	14	43	43	17	40
Memorex	68	7	25	66	11	23
Mohawk	50	35	15	50	35	15
NAS	61	10	29	61	10	29
STC/Documation	65	15	20	65	15	20
Telex	47	40	13	47	47	6
Xerox	60	15	25	65	10	25

EXHIBIT V-5

FIELD SERVICE ENGINEER IN SALES ROLE - ALL VENDORS (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	0.7%	28%	12%	35%	24.3%
Hardware Features	2.0	55	8	21	14
Add-on Features	2.0	53	6	25	14
New Models	2.0	51	9	24	14
Upgrades	0.5	57	8	18	12
Software Packages	0.3	32	12	35.7	20

repair. The engineers' compensation for selling cannot be so attractive that it changes their attitude concerning primary responsibilities.

- Although most users favor field service engineers that sell, individual results vary, and in this report individual statistics will be used to make recommendations to vendors.

G. USER EVALUATION OF FIELD ENGINEERS IN A SALES ROLE

- CDC.
 - The results in Exhibit V-6 mirror the overall users' responses. An effective field service sales program could be instituted to increase overall sales resources.
- Centronics.
 - Users' responses are similar to overall results. One area that Centronics users seem fairly divided on is software package sales. It appears that field engineering could be very effectively used in all areas except supplies sales, as shown in Exhibit V-7.
- Decision Data.
 - Exhibit V-8 shows that Decision Data could use field service for handling all after-initial sales activities except the sale of supplies. Supplies could be handled by an independent sales group dedicated to that function. This is the way most vendors sell supplies.

EXHIBIT V-6

FIELD SERVICE ENGINEER IN SALES ROLE - CDC (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	15%	35%	35%	15%
Hardware Features	-	65	0	30	5
Add-on Features	-	60	5	30	5
New Models	-	55	0	35	10
Upgrades	5%	70	0	20	5
Software Packages	-	35	10	50	5

EXHIBIT V-7

FIELD SERVICE ENGINEER IN SALES ROLE - CENTRONICS (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	10%	10%	60%	20%
Hardware Features	-	80	-	20	-
Add-on Features	-	80	-	20	-
New Models	10%	50	-	40	-
Upgrades	10	70	-	20	-
Software Packages	-	50	10	40	-

EXHIBIT V-8

FIELD SERVICE ENGINEER IN SALES ROLE
- DECISION DATA
(percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	40%	5%	45%	10%
Hardware Features	5%	70	10	15	-
Add-on Features	5	75	5	15	-
New Models	10	70	5	10	5
Upgrades	5	80	5	10	-
Software Packages	-	55	10	30	5

- IBM.
 - Although most users would accept field service personnel in a sales role, the results in Exhibit V-9 show that only the sale of upgrades has good support. Changes to existing practices should be carefully considered before being instituted.
- ITT.
 - Using field service in a sales role should not be considered at this time. Several users have strong oppositions and although response is divided, this is not the time to change, as shown in Exhibit V-10.
- Memorex.
 - In all areas (including supplies) users seem favorable to dealing with field service in a sales role. Only software package sales are opposed. The majority of opposed users are only mildly concerned, as shown in Exhibit V-11.
- Mohawk.
 - Exhibit V-12 shows that Mohawk has support from users for field engineering involvement in all sales areas but software and supplies. A program could be instituted for all hardware after-sales services.
- NAS.
 - Using field engineering in a sales role may not prove effective. There are several users that strongly oppose any field engineering involvement. Since users are generally satisfied with most of the services NAS provides, changing now may not be wise. Details are shown in Exhibit V-13.

EXHIBIT V-9

FIELD SERVICE ENGINEER IN SALES ROLE - IBM (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	13%	10%	45%	32%
Hardware Features	3%	45	8	28	16
Add-on Features	3	47	5	33	12
New Models	-	48	12	28	12
Upgrades	8	48	12	22	10
Software Packages	-	27	13	43	17

EXHIBIT V-10

FIELD SERVICE ENGINEER IN SALES ROLE

- ITT
(percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	33%	7%	33%	27%
Hardware Features	-	47	3	27	23
Add-on Features	-	43	3	33	21
New Models	-	40	3	36	21
Upgrades	-	47	3	30	20
Software Packages	-	30	3	40	27

EXHIBIT V-11

FIELD SERVICE ENGINEER IN SALES ROLE - MEMOREX (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	2%	48%	13%	27%	10%
Hardware Features	5	66	11	13	5
Add-on Features	5	66	7	18	4
New Models	2	59	11	22	6
Upgrades	9	66	7	14	4
Software Packages	-	32	23	34	11

EXHIBIT V-12

FIELD SERVICE ENGINEER IN SALES ROLE - MOHAWK (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	45%	5%	30%	20%
Hardware Features	-	55	10	20	15
Add-on Features	5%	50	5	25	15
New Models	-	60	10	20	10
Upgrades	5	55	10	20	10
Software Packages	5	35	10	35	15

EXHIBIT V-13

FIELD SERVICE ENGINEER IN SALES ROLE

- NAS
(percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	14%	14%	38%	34%
Hardware Features	-	57	-	14	29
Add-on Features	-	57	-	14	29
New Models	-	48	5	18	29
Upgrades	-	52	5	14	29
Software Packages	-	24	14	33	29

- STC.
 - The overall responses for STC that are in Exhibit V-14 make the decision to use field service in a sales role very questionable. Many users have strong opposition in all areas surveyed.
- Telex.
 - Users favor hardware features, new models, and upgrades to a strong degree. Interestingly, add-on features are not included; they are generally opposed to the same degree as are software packages and supplies. Field engineering involvement should be explored in the area of upgrades with other items added later. Details are shown in Exhibit V-15.
- Xerox.
 - Users are generally opposed to any field engineering involvement in sales. Several other areas in the survey require improvements before additional responsibilities are added to field service, as shown in Exhibit V-16.

H. DISPATCHING AND ESCALATION OF EXTENDED DOWNTIME SITUATIONS

I. DISPATCHING

- The users' views on dispatching of trouble calls are very similar to other technical questions within the survey. Overall, the industry does very well. Xerox should investigate to see if their users are really concerned about specifics within the survey, or whether a general feeling of dissatisfaction

EXHIBIT V-14

FIELD SERVICE ENGINEER IN SALES ROLE - STC (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	35%	10%	15%	40%
Hardware Features	-	48	12	18	22
Add-on Features	-	48	12	20	20
New Models	-	50	12	20	18
Upgrades	-	52	12	23	13
Software Packages	-	30	5	30	35

EXHIBIT V-15

FIELD SERVICE ENGINEER IN SALES ROLE - TELEX (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	7%	26%	20%	34%	13%
Hardware Features	7	60	13	13	7
Add-on Features	-	40	13	40	7
New Models	7	53	13	20	7
Upgrades	7	66	13	7	7
Software Packages	-	40	20	26	14

EXHIBIT V-16

FIELD SERVICE ENGINEER IN SALES ROLE - XEROX (percent)

ITEMS	FAVOR		NEUTRAL	OPPOSED	
	Strongly	Mildly		Mildly	Strongly
Supplies	-	10%	15%	40%	35%
Hardware Features	-	45	5	20	30
Add-on Features	-	30	10	25	35
New Models	-	25	10	25	40
Upgrades	-	40	5	15	40
Software Packages	-	15	10	20	55

exists. In any event, the survey indicates a need for improvement on Xerox's part.

- The increased use of centralized dispatch has been very effective in creating a high level of customer satisfaction. Judging from the results shown in Exhibit V-17, this services group could effectively be used for taking supplies sales orders.

2. ESCALATION OF EXTENDED DOWNTIME SITUATIONS

- The user ratings are interestingly similar to those of service management communications. Exhibit V-18 shows most vendors doing well. Those having poor ratings elsewhere are again rated lower than the mean.
- Alert procedures are fairly common in format throughout the industry, so the results of the survey must reflect the manner in which they are executed. Another factor is what the user perceives is occurring. This is the result of communications with the people responsible. If these communications are poor, it manifests itself when serious problems arise. Strong site management by field service could lessen the stress between the user and vendor, and could turn a potential loss of future equipment sales into increased user respect for the vendor.

I. CONTRACT ADMINISTRATION

- Users' responses differ on many issues concerning maintenance contracts. This appears to be vendor sensitive; overall results are somewhat misleading. Long-term contracts of over one year are favored by most users, but Centronics and Xerox customers are strongly opposed and prefer a shorter contract cycle. Automatic renewal also shows general desirability on the part of most users; however, Mohawk, ITT, Decision Data, and Memorex users are

EXHIBIT V-17

USER RATINGS OF VENDORS WITH RESPECT TO DISPATCHING OF TROUBLE CALLS

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.6	1.9	8.0	8.0	300
CDC	8.2	1.9	8.0	8.0	20
Centronics	7.0	1.3	7.0	7.0	10
Decision Data	7.7	2.2	8.5	9.0	20
IBM	7.5	1.9	8.0	8.0	60
ITT	7.8	1.7	8.0	8.0	29
Memorex	7.3	1.8	8.0	8.0	43
Mohawk	7.9	1.8	8.0	8.0	20
NAS	7.7	1.6	8.0	8.0	21
STC/Documation	7.7	1.5	8.0	9.0	40
Telex	8.2	1.2	8.0	8.0	14
Xerox	6.9	1.6	6.5	6.5	20

EXHIBIT V-18

USER RATINGS OF VENDORS WITH RESPECT TO ESCALATION OF EXTENDED DOWNTIME

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.4	3.5	8.0	8.0	254
CDC	7.7	1.9	8.0	8.0	17
Centronics	8.3	0.5	8.5	8.5	8
Decision Data	6.8	2.5	8.0	8.0	15
IBM	7.2	2.2	8.0	8.0	51
ITT	8.0	1.1	8.5	8.0	24
Memorex	7.3	2.1	8.0	9.0	40
Mohawk	7.8	1.9	8.0	8.0	16
NAS	7.6	2.2	8.0	8.0	21
STC/Documation	6.9	2.3	8.0	8.0	31
Telex	7.0	1.8	7.0	7.0	11
Xerox	6.5	2.4	7.0	7.0	18

opposed. Variable shift coverage is an item where any opposition would be surprising; however, Centronics and Telex users are somewhat opposed. Standardized forms are opposed by almost as many users as there are users that favor them.

- Administration of these contracts will continue to become more difficult. Customers are becoming aware of how field service calculates costs and are beginning to request discounts when none is offered. Third-party maintenance companies further confuse the overall contract picture.
- Maintenance contract options results are shown in Exhibit V-19. Weekend preventive maintenance and field changes during off hours, on-site spares, and guaranteed response time are the most requested options. At first review, the survey shows that users are unwilling to pay a reasonable premium for these services. But if individual results are carefully checked, several users feel these services should be free. Of the respondents that felt premiums were a reasonable request, 10% was a fairly frequent suggestion for the premium's size.
- In the peripheral area, items such as guaranteed uptime, occasional shift coverage, and several other options do not have the user appeal that they would in systems surveys. Since several of these options are offered by system manufacturers, they will become more common throughout the industry and will be required more often by peripheral users.
- Due to their size and portability, terminals will have a different set of options than most peripherals. Sparing prices and whether spare units require maintenance contracts will become service questions for the vendor. At first glance it seems questionable whether spares should carry maintenance contract requirements. However, if spares are or can be made into a complete unit, then customers can use them as additional terminals. This affects MTBF figures and field service revenue possibilities.

EXHIBIT V-19

USER EVALUATION OF MAINTENANCE CONTRACT OPTIONS
- ALL VENDORS
(percent)

SERVICE	YES	NO	AVERAGE MEAN PREMIUM
Standby coverage during critical periods	22%	78%	3.1%
Guaranteed uptime	24	76	3.5
Guaranteed response time	33	67	2.6
On-site spare parts	34	66	1.4
Remote diagnostics	19	81	1.5
Preventive maintenance and changes during off hours	40	60	2.7
Occasional shift coverage (versus fixed schedule)	27	73	2.0
Full-time, on-site field engineer	7	93	2.0
Guaranteed repair time (hardware)	20	80	4.0
Guaranteed turnaround time on software fixes	7	93	3.8

- Since user responses to contract questions were so varied, the results concerning the provisions favored and opposed have been individualized. Exhibit V-20 shows overall results and can be used for comparison.
 - CDC user responses.
 - Exhibit V-21 shows that users favor long-term contracts with automatic renewal.
 - User response to standardized forms is divided; therefore, these forms are not recommended at this time. Annual invoicing is strongly opposed; however prepayment discounts could change this.
 - The offering of variable shift coverage is an opportunity for increased revenues.
 - Centronics user responses.
 - Centronics' results differ significantly from the overall vendor responses. This is due primarily to the products involved. Details are shown in Exhibit V-22.
 - Long-term contracts and variable shift coverage are strongly opposed, while automatic renewal, standardized forms, and annual invoicing are favored.
 - Volume discounts and other creative maintenance methods could assist in increasing revenues. By offering these options, more maintenance contracts would be possible.

EXHIBIT V-20

USER REQUIREMENTS FOR CONTRACT OPTIONS
- ALL VENDORS
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	54%	8%	38%
Automatic Renewal	54	10	36
Variable-shift Coverage	70	11	19
Standardized Forms	50	12	38
Annual Invoicing	22	12	66

EXHIBIT V-21

USER REQUIREMENTS FOR CONTRACT OPTIONS
- CDC
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	60%	-	40%
Automatic Renewal	65	-	35
Variable-shift Coverage	80	-	20
Standardized Forms	40	15%	45
Annual Invoicing	20	-	80

EXHIBIT V-22

USER REQUIREMENTS FOR CONTRACT OPTIONS
- CENTRONICS
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	30%	-	70%
Automatic Renewal	70	20%	10
Variable-shift Coverage	20	40	40
Standardized Forms	80	-	20
Annual Invoicing	60	10	30

- Decision Data user responses.
 - Long-term contracts and standardized forms are favored by most of Decision Data's users. One unusual result is the opposition to automatic renewal.
 - According to Exhibit V-23, annual invoicing is strongly opposed, but a real opportunity exists in offering variable shift coverage.
- IBM user responses.
 - Due to the larger number of responses, IBM results mirror the overall results. In the area of variable shift coverage their users are the most positive.
 - Annual invoicing is strongly opposed; however, terminals users may differ. Results are shown in Exhibit V-24.
 - Interestingly, users are divided on the question of standardized forms.
- ITT user responses.
 - Long-term contracts and standardized forms are favored by most ITT users. According to Exhibit V-25, automatic renewal results are split. This is different from the norm, but users' neutrality make this a possible offering.
 - Variable shift coverage is favored by the users and is an opportunity for ITT to increase revenues. Annual invoicing is as opposed by ITT users as it is by users of most of the other peripherals vendors.

EXHIBIT V-23

USER REQUIREMENTS FOR CONTRACT OPTIONS - DECISION DATA (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	70%	10%	20%
Automatic Renewal	45	5	50
Variable-shift Coverage	70	15	15
Standardized Forms	55	5	40
Annual Invoicing	15	5	80

EXHIBIT V-24

USER REQUIREMENTS FOR CONTRACT OPTIONS
- IBM
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	52%	8%	40%
Automatic Renewal	58	12	30
Variable-shift Coverage	80	10	10
Standardized Forms	43	15	42
Annual Invoicing	25	13	61

EXHIBIT V-25

USER REQUIREMENTS FOR CONTRACT OPTIONS - ITT (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	60%	10%	30%
Automatic Renewal	40	13	47
Variable-shift Coverage	66	13	21
Standardized Forms	50	20	30
Annual Invoicing	20	17	63

- Memorex user responses.
 - . Only variable-shift coverage shows a significant number of users in favor. Long-term contracts are split, with a higher than normal number of users being opposed.
 - . Automatic renewal is opposed surprisingly strongly by Memorex users. Overall, any changes to existing maintenance contract options, other than variable-shift coverage, is questionable. Details are shown in Exhibit V-26.
- Mohawk user responses.
 - . Users favor long-term contracts, but oppose automatic renewal. Exhibit V-27 shows that Mohawk users favor standardized forms more than do users overall.
 - . Annual invoicing is strongly opposed, which is consistent with the rest of the industry surveyed.
 - . Variable shift coverage is favored by most Mohawk users, but not to the extent that it is favored by users of several other vendors.
- NAS user responses.
 - . According to Exhibit V-28, NAS users favor long-term contracts with automatic renewal and standardized forms. Only annual invoicing received strong opposition.
 - . Variable-shift coverage plans are definite opportunities for NAS to increase revenues.

EXHIBIT V-26

USER REQUIREMENTS FOR CONTRACT OPTIONS - MEMOREX (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	48%	9%	43%
Automatic Renewal	25	7	68
Variable-shift Coverage	73	5	22
Standardized Forms	39	7	54
Annual Invoicing	27	16	57

EXHIBIT V-27

USER REQUIREMENTS FOR CONTRACT OPTIONS - MOHAWK (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	50%	20%	30%
Automatic Renewal	30	10	60
Variable-shift Coverage	50	35	15
Standardized Forms	60	20	20
Annual Invoicing	15	20	65

EXHIBIT V-28

USER REQUIREMENTS FOR CONTRACT OPTIONS

- NAS
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	62%	5%	33%
Automatic Renewal	52	5	43
Variable-shift Coverage	71	9	20
Standardized Forms	67	5	28
Annual Invoicing	24	5	71

- STC user responses.
 - . Exhibit V-29 generally reflects the attitude of most of the users who were surveyed. STC users are, however, more strongly opposed to annual invoicing.
 - . Variable shift coverage shows a greater level of support than any other vendor's results. This provides an excellent way for STC to increase maintenance revenues.
- Telex user responses.
 - . Surprisingly, Telex users oppose variable shift coverage. This could be because of the nature of the product sector surveyed. Annual invoicing is also strongly opposed.
 - . Other surveyed areas were favored, with 60% of the users desiring long-term contracts. Exhibit V-30 has the results.
- Xerox user responses.
 - . Interestingly, Xerox users opposed long-term contracts but slightly favored automatic renewal. Standardized forms also received a positive response.
 - . Exhibit V-31 shows strong support for variable shift coverage, giving Xerox the same opportunity that several other vendors have.

EXHIBIT V-29

USER REQUIREMENTS FOR CONTRACT OPTIONS
- STC
(percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	62%	3%	35%
Automatic Renewal	53	3	44
Variable-shift Coverage	83	3	14
Standardized Forms	47	8	45
Annual Invoicing	12	13	75

EXHIBIT V-30

USER REQUIREMENTS FOR CONTRACT OPTIONS - TELEX (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	60%	7%	33%
Automatic Renewal	53	13	34
Variable-shift Coverage	33	7	60
Standardized Forms	60	7	33
Annual Invoicing	20	-	80

EXHIBIT V-31

USER REQUIREMENTS FOR CONTRACT OPTIONS - XEROX (percent)

CONTRACTS	FAVOR	NEUTRAL	OPPOSED
Long-term Contracts (Over one year)	35%	20%	45%
Automatic Renewal	50	25	25
Variable-shift Coverage	80	15	5
Standardized Forms	55	15	30
Annual Invoicing	20	20	60

J. RESOLUTION OF INVOICING DISPUTES

- The ratings for the resolution of invoicing disputes are very vendor oriented. To try to make any general conclusions from the responses on Exhibit V-32 would be foolish. Invoices are handled in different departments by different vendors. Large vendors give this responsibility to FEs; others rely on corporate accounting. Each vendor sets up different procedures for questionable billings and should review its own individual results.
- However, regardless of the department handling this responsibility, the survey results demonstrate the users' perceptions of how effectively the resolution of invoicing disputes is being administered. It is another example of vendor communication; any result that is less than 7.0 is unacceptable. Several vendors need to work on improving their overall ratings.

K. FREQUENCY OF VENDOR/USER CONTACTS

- This survey does not measure the frequency of vendor/user contacts, but does measure the effectiveness of those contacts. Most vendors have established customer service visits as an integral part of the field manager's job. Once the total service concept is adopted and the field engineer is given overall customer responsibility, this program will become even more effective. From overall survey results it appears that field service engineers have established a rapport that is in most cases more positive than that of anyone else in the vendor organization. This is to be expected because of the history of the field engineering function. FEs are normally involved with the user when things are not going well. By correcting the situations that arise, FEs become part of the user's team. Two vendors make use of this valuable resource.

EXHIBIT V-32

USER RATINGS OF VENDORS WITH RESPECT TO
RESOLUTION OF INVOICING DISPUTES

VENDOR	RATINGS (1-10)				NUMBER OF RESPONSES
	Mean	Standard Deviation	Median	Mode	
All Vendors	7.1	2.5	7.0	8.0	236
CDC	7.8	1.1	8.0	9.0	16
Centronics	7.6	2.0	8.0	8.0	9
Decision Data	6.9	2.7	7.0	8.0	14
IBM	7.3	1.7	8.0	8.0	54
ITT	6.1	2.6	7.0	7.0	26
Memorex	6.6	2.0	7.0	8.0	35
Mohawk	7.6	2.1	7.5	8.0	14
NAS	7.5	1.8	8.0	8.0	18
STC/Documation	7.4	2.0	8.0	8.0	21
Telex	7.4	2.4	8.0	8.0	11
Xerox	6.6	2.2	7.0	7.0	15

- The customer visit program should be very structured. Survey questions and ratings should be requested during the visit. Although many managers may feel uncomfortable in this environment, such structure will pay future dividends.

VI FIELD SERVICE PRICING

VI FIELD SERVICE PRICING

A. USER RESISTANCE TO PRICE INCREASES

- Travel, telephoning, and administration have had a significant effect on maintenance rates over the past several years. Labor costs, interest rates, and facilities expenses have also constantly risen, though at a slightly decreased rate. Vendors are now trying to be creative by providing new methods of service.
- Nowhere has this been more prevalent than in the terminal and small-systems sectors of the industry. Users have expressed their displeasure and are reluctant to make use of these programs.
- One other factor adding to the vendors' dilemma is the increased activity of third-party maintenance companies in the peripheral sector of the business. With all these choices the user has become very aware of how service pricing is structured, and this awareness puts pressure on the vendor.
- One item not obvious to the user is the support overhead that is attached to a product during research and development by the support groups responsible for engineering changes. Most vendors have attempted to recover these costs through maintenance revenues. This naturally forces vendor maintenance rates to be higher than those of third-party maintenance companies. In the past, parts costs created an expense that discouraged third-party maintenance

companies from supporting high-volume products. Now independent depots are repairing or reverse-engineering spare parts at a cost close to that of vendors.

- Volume discounts for maintenance are now becoming commonplace in the industry and will become increasingly competitive in the future. The phrase "product in one location" is now requiring a stricter definition. Administering all these options is becoming complex and difficult.

B. SERVICE-RELATED PRICE ELASTICITY

- With several vendors openly negotiating maintenance prices, it is not surprising that a growing number of users are opposed to standard maintenance forms. The result of the price negotiations has yet to affect overall vendor net profits.
 - Some legitimate methods of reducing maintenance prices are the establishment of repair centers, the maintenance of customer-replaceable modules, and the establishment of scheduled biweekly maintenance. Users will become more agreeable to these plans if the plans can still be provided with the same personnel involvement that is found in traditional or on-site maintenance.
 - Hardware and software maintenance plans were originally separate. Over the last several years vendors have been combining these into a generalized maintenance offering. This has many advantages to both the vendor and user. Customers have always had difficulty understanding that software can fail or require repair.
 - Many users have expressed concern about the extent that rates will vary. They feel that any concessions given to one customer because of

the user's situation should be offered to all. Also, it's necessary to create a clear definition of terms that standardizes the contractual words used throughout the user base.

- Very few service vendors have regular reviews of the service price elasticity of their products. This calculation should be important to every service manager attempting to optimize service revenues; service price elasticity has been studied extensively in other industries.
- One should establish a relationship between service pricing and the potential gain or loss in revenue. An essential assumption is that all elements (such as options and service methods) remain constant. Any changes require another review of the price/demand curve.
- With several product lines, each type of product must be figured separately. When calculating the price/demand curve for terminals, the curve becomes very sharp because of the number of customers gained or lost when maintenance prices vary. This would be true for all high-volume products, which have competitive focus from other maintenance organizations.

C. SERVICE PERFORMANCE GUARANTEES

- In the peripheral and terminal areas service guarantees are not marketable products. A critical need for an individual product use may change this, but at this time service performance guarantees are not attractive to users. Administrative overhead would not be worth the bother for the few users needing it.

D. DELIVERY-MODE-RELATED DISCOUNTS

- Several methods of reducing standard labor costs are being used. They are as follows:

- Volume discounts, based on reduced travel costs and parts expense: This is the most accepted of all discount services, especially in the terminal and terminal-type product markets. It offers traditional on-site maintenance (the most popular maintenance mode, as seen in Exhibit VI-1) at a reduced cost. An example of savings are:

- I-terminal cost

I hour travel	\$100
I hour repair time	100
I spare cost	<u>250</u>
	\$450 per terminal

- IO-terminal cost

I hour travel	\$ 10
I hour repair	100
I spare cost	<u>250</u>
	\$360 per terminal

- Parts costs are saved because one spare set stocked at the site serves a larger volume of products. The cost of parts doesn't change, but fewer are required.
- Customers performing problem determination (assisted by a remote diagnostic/support center): Here the discount is based on the reduced number of FEs required per product. The customer calls in with the defective part already identified. This is not being very well accepted, either with remote center support or without. Judging from the average FE repair time estimate, it is not yet a viable method of service in the peripheral sector of the industry.

EXHIBIT VI-1

USER RATINGS OF
METHODS OF HARDWARE MAINTENANCE

VENDOR	HARDWARE					
	Traditional On-site Response	Customer Working Without Remote Center	Customer Working With Remote Center	Customer Replacing Components	Delivering Modules to Repair Center	On-site Stand by During Critical Periods
All Vendors	8.3	5.8	6.0	4.6	3.4	4.2
CDC	7.5	5.4	5.5	4.7	3.0	3.8
Centronics	8.9	4.5	5.2	3.0	2.8	2.3
Decision Data	8.5	4.8	5.5	5.1	3.3	2.4
IBM	7.7	6.1	5.7	3.4	3.0	5.5
ITT	8.3	5.9	6.3	5.2	3.5	4.1
Memorex	8.0	5.9	5.6	4.4	3.9	4.6
Mohawk	8.5	6.1	4.8	4.3	3.4	3.6
NAS	8.9	5.2	6.6	4.0	3.5	6.2
STC/Documation	8.4	5.4	5.5	5.3	3.9	3.2
Telex	8.4	4.4	5.6	6.3	4.6	3.2
Xerox	6.9	5.4	5.6	3.0	2.2	3.9

- Customers replacing components: This eliminates the need for a field engineer's involvement. Users' responses make it very doubtful that this repair method will be accepted until users have in-house support of their own. Customer component replacement may become a feasible program when users make that commitment. A product's reputation could be damaged by poor maintenance and this would be out of the vendor's control.
- Delivering modules to a repair center: Several vendors are moving in this direction but, if the survey is accurate, this trend will meet user opposition. It could end up costing vendors more by forcing them to offer traditional maintenance as well as repair center maintenance. Volume reduces cost; when subdivided, volume's advantage is lost.
- On-site standby maintenance during critical periods: Judging from the survey responses in Exhibits VI-1 and VI-2, users are not impressed with this service. It would also be difficult for vendors to manage with the limited resources this plan requires.
- Scheduled or biweekly maintenance: This method was not surveyed but is being provided by some vendors. FEs have predetermined routes for terminal products and for those products of modular construction that lend themselves to this form of maintenance. Scheduled maintenance still provides a maintenance plan with personal contact and uses the advantage gained from modularity.

E. UNBUNDLING (HARDWARE AND SOFTWARE)

- This is favored by users throughout the industry. It is an advantage as well as a challenge to vendors. Today field engineering costs during development and

EXHIBIT VI-2

USER RATINGS OF
METHODS OF SOFTWARE MAINTENANCE

VENDOR	SOFTWARE					
	Traditional On-site Response	Customer Working Without Remote Center	Customer Working With Remote Center	Customer Replacing Components	Delivering Modules to Repair Center	On-site Stand by During Critical Periods
All Vendors	8.1	6.0	6.2	4.8	3.6	4.4
CDC	8.5	6.1	5.9	4.4	3.0	3.8
Centronics	7.9	4.0	5.0	2.9	2.7	2.2
Decision Data	8.5	4.7	5.3	5.0	3.2	5.3
IBM	7.0	5.8	5.8	4.6	2.9	5.1
ITT	8.5	6.5	7.0	5.0	3.0	4.0
Memorex	7.3	6.2	5.6	4.7	3.8	4.4
Mohawk	8.4	6.2	4.9	4.3	3.6	3.6
NAS	8.5	5.2	6.6	4.0	3.3	5.9
STC/Documation	8.2	6.1	5.8	4.6	3.9	3.2
Telex	6.3	3.8	4.7	6.0	3.6	2.3
Xerox	8.0	6.0	6.5	3.0	2.0	5.0

engineering are recovered through maintenance revenues. With unbundling these costs will be forced to be included in product costs. Without maintenance requirements, vendor field engineering groups will compete with third-party maintenance organizations. Those organization have to invest little or no R&D cost and are very competitive in nature. To maintain account control and assist in future sales, vendor maintenance prices must be competitive.

- The biggest impact may be in the sales area. It is not an easy situation to deal with, but unless product prices include all costs, the corresponding revenues will never be realized. Thus corporate profits will be dangerously low during the period in between product cycles. Because of this, many vendors will divisionalize field service in the coming years. Unless field service has the authority necessary within the vendor organization, third-party maintenance companies will prosper.

VII STRATEGY RECOMMENDATIONS

VII STRATEGY RECOMMENDATIONS

A. USER REQUIREMENTS FORECAST AND TIMING

- According to Exhibit VII-1, users consider the following applications to be most critical:
 - Order entry/accounts receivable.
 - Payroll.
 - Timesharing.
- Process control equipment is expanding within the marketplace. The impact of downtime is more critical in this environment because one never really recovers the time without incurring high costs.
 - Over the next four years new communication methods will affect the user organizations. Ethernet is a method of allowing several devices to share the same line, with protocols used to identify devices. As this technology evolves, vendors will have equipment communications with other manufacturers' equipment. This arrangement will allow the user to share stored information and resources with everyone in the organization. New challenges will be created for all field service groups. New diagnostic methods and equipment must be designed to assist field

EXHIBIT VII-1

USER RESPONSES TO CRITICALITY OF APPLICATIONS

ALL VENDORS	THREE APPLICATIONS RATED MOST CRITICAL	(1-10) RATING OF DOWNTIME EFFECT
Order Entry/Accounts Receivable	X	9.0
Purchasing/Accounts Payable		8.7
General Ledger Accounting		8.1
Payroll	X	9.3
Materials/Inventory Controls		9.2
Cost Accounting		8.4
Engineering, Design/CAD		8.6
Process Control/CAM		10.0
Pert/CPM		-
Timesharing	X	9.3
Reservations		7.8
Scientific Analysis		10.0
Business Modelling		10.0
Business Graphics		-
Transaction Control		8.9
Other		-

engineers in determining which device is failing. Also, equipment that is embedded in the network will require maintenance.

- Training the field engineer to handle this environment will not be an easy task. Methods will have to be employed that allow large segments of the field service groups to be trained in a short period of time. The use of videotape and CAI will be required if this is to be completed successfully.
- Field service must be involved in new-product design. Between 1983 and 1986 the design criteria for terminal and other portable equipment will be established. These criteria will establish industry standards in modular design. By involving field service, maintainability and serviceability issues will be addressed and ease of repair guaranteed.
- Users will require support that is more accessible. The merging of hardware and software functions should be considered by all vendors. If customers are to be used to assist in problem determination, a single maintenance contact must be established for them. The expenditures necessary to maintain both a hardware and software maintenance group will be prohibitive.
- Cost of ownership will become more critical to users in the next several years. It is entirely possible that users will request cost-of-ownership guarantees from vendors. If this occurs, vendors can only blame themselves because several have used this in tight sales situations.
- Several users felt that off-hour maintenance is a very logical request. Vendors must be prepared to offer flexible maintenance plans. This need is prevalent now and will only increase in the future. Variable-shift coverage, staggered-week coverage, and response time guarantees are but a few flexible plans. If vendors take the attitude that this service is unreasonable, third-party maintenance companies will increase their revenues. Service is a business and must be competitive.

- In several vendor organizations the development of diagnostics is not properly handled. In several cases these diagnostics are no more than engineering and development verification tests. It is totally unreasonable to expect users to assist in problem determination without diagnostic tools created for their level of expertise. This could explain some of the users' reluctance to become involved in equipment maintenance.
- Sparing philosophies must be streamlined to meet user requirements. Modular construction will assist in this but will not correct the problem. Several existing sparing plans are excellent, but their execution leaves much to be desired. If pressure for on-site sparing is to be alleviated, better stocking procedures must be put into place.
- Software support requirements for peripherals and terminals will become more critical within the next few years. As new technologies of communication equipment and unfamiliar interfaces are introduced, the confusion between hardware and software malfunctions will begin to be felt in this section of the industry as it is now being experienced in the systems area. Responsiveness in the software maintenance area can be accomplished by using field service engineers in an expanded role.
- Terminal vendors must continue to look for creative methods to maintain their product. Service centers will eventually become accepted in the user community, but methods of pickup and delivery must be investigated. The use of agents in remote areas should also be considered.
- Vendors should establish a hotline allowing customer personnel to have direct contact with trained support people. This service could be marketed to offset costs. Several comments from the survey asked for more cooperation and communication with vendor personnel. If this request is ignored users will go elsewhere for service.

B. SERVICE OPPORTUNITIES, 1983-1988

- One clear opportunity arising now is cooperative vendor maintenance. Under this method vendors maintain each other's products in geographic areas where one of the vendor's support resources is inadequate. This method is extremely effective in allowing vendors to move into remote areas not supported at this time. It is also valuable when one vendor's equipment interfaces with another's. Peripheral/terminal manufacturers should explore this possibility.
- As INPUT discovered in the survey, after-sales support is a very viable business for field service in most vendor organizations. It will expand the field engineers' career opportunities and increase vendor revenue. What field engineers put into a sales role will enlarge the vendor's overall sales resources.
- Maintenance management contracts will be increasing in number as new communications methods are introduced. This is an opportunity for vendors to work closely with users in assisting users to improve their overall system operations.
- Several vendors in the small-system sector of the business are offering hardware maintenance on equipment that isn't of their own manufacture. In a sense they do third-party maintenance, thus increasing the volume of products supported in a location and increasing revenue. Terminal vendors should investigate the feasibility of this approach.
- Product design is an area in which field service could really assist vendors now and in the future. Modularity is being instituted throughout the industry in order to facilitate parts replacement and fault isolation. If maintenance models are designed at the same time that engineering is defining specifications, cost of ownership could be reduced via new service methods.

- Third-party maintenance companies may have the greatest opportunity for growth in the next three years. As new start-up companies begin shipping, product support can be handled with a minimum of impact to the vendor. The TPM supplier brings its expertise in field service to the equipment vendor and provides the user with a professional, in-place maintenance resource. Third-party companies have always filled the gaps in the service that vendors provide. In the next few years, these gaps could become larger unless vendor maintenance organizations take service seriously. Without the R&D maintenance costs, third-party rates will be extremely competitive. Vendors are going to be hard pressed to convince the user to accept vendor maintenance. Field service can be a major revenue producer for corporations if managed properly. Unbundling maintenance requirements will increase competitive pressures for the next several years.

C. REVENUE SOURCE PROJECTIONS

- Hardware maintenance revenue as a percentage of installed base will drop over the next several years in the peripheral and terminal section of the business. Lower parts expense and greater field engineering productivity will cause this reduction. However, several companies will incorporate software maintenance charges for the first time. With the merging of hardware and software maintenance groups, revenue could increase substantially.
- When repair centers and depot maintenance are accepted by the user community, control of maintenance costs will be realized, and this will result in significant profits. Acceptance of this type of maintenance will take longer than originally anticipated, but eventually this will become the normal way of repairing equipment modules.

- Maintenance management contracts will increase in number during the next five years. The main expertise required will be in communications. This service produces revenue for the vendor but requires little in the way of additional service resources. Maintenance management contracts also enable vendor organizations to influence future user applications and equipment purchases.
- As field engineering becomes involved in a sales role, vendors' overall revenue will increase. Add-on activity and other services will contribute to overall sales revenue. This revenue is not, in some cases, service revenue and should not remain within the field service group. Increases in maintenance options and services could provide a 10% to 20% increase in field service revenue.
- Upper management within vendor organizations will become more concerned with the terms of new maintenance contracts. Over the past couple of years some vendors have experienced the consequences of inadequate maintenance contract control. Some contracts have affected the corporate profits in such a manner that they have eliminated sales profits. Whether philosophically field service is considered a profit center or a break-even situation is irrelevant. Any built-in losses occur every month and are irreversible. By making sure contracts cover expenses, revenue should increase throughout the industry.
- After-sales support functions should be assigned to field engineering in phases. After reviewing individual survey results, vendors should take the most accepted area and let the organization become accustomed to managing that function.
- Customer relocation and territory management training should be instituted by all vendors. These classes should be conducted for all support and management personnel. Responsiveness, being a key to the overall service image of a vendor, should be concentrated on until the problem is resolved. The training will convey a sense of importance to both the employees and users.

To survive in the coming world of networking and resource-sharing systems, users and vendors will have to work more closely than ever before.

D. RECOMMENDATIONS

- In order to provide a high level of service on a continuing basis, field engineering should be divisionalized within vendor organizations. Their charter, functions, and authority should be clearly stated so all other facets of the business understand their purpose. They should in no way be connected to the marketing organization and should have sign-off procedures within the development group. This forces the service organization to operate as a business and not drain corporate revenue. When reviewing the results of the survey several comments about vendor responsiveness and management communications could not be assigned to field service. In some vendors' operations, software maintenance, invoicing, and site management are the responsibilities of other groups, with field service having little to say about their effectiveness. Some large vendors found this unworkable years ago and gave field engineering total responsibility over all service issues. The results have been very positive.
- Field service development costs should be included in product development costs. (Several manufacturers do not do this in order to minimize the cost of products.) This creates a burdened hourly rate for field service because of the imposition of the field service development overhead. Although this reduces the price paid by users for the product, it could have serious consequences.
- With this ever increasing hourly rate, vendors have difficulty competing with third-party maintenance companies on maintenance contracts. By including field service development costs in the product price, vendors cover their outlay and are able to compete in the maintenance marketplace. This is becoming evident in the terminal and office product portion of the systems

business. High-volume products can produce significant maintenance revenue and the scramble for this revenue is now happening.

- Vendors with products in all areas of the systems business should combine FE and software groups. Product specialization with field engineering is becoming less important, while needs for better user communications and site management are growing. This will also assist in the sale of maintenance management contracts.

APPENDIX A: USER QUESTIONNAIRE

Interview Profile*PRODUCT

Vendor	Tape	Disk	Printer	Terminals
IBM	_____	_____	_____	_____
CDC	_____	_____	_____	_____
NAS	_____	_____	_____	_____
STC/Documation	_____	_____	_____	_____
Memorex	_____	_____	_____	_____
Mohawk (MDS)	_____	_____	_____	_____
Centronics	_____	_____	_____	_____
Xerox	_____	_____	_____	_____
Courier	_____	_____	_____	_____
Telex	_____	_____	_____	_____
Decision Data	_____	_____	_____	_____

* DATA ENTRY: Enter only one vendor and one product type per questionnaire.

1. On a scale of 1-10, please rate _____ (vendor)
in the following categories:

	(1-10)
a) Service management communication	_____ (A1)
b) Hardware service engineer's communication	_____ (A2)
c) Software service engineer's communication	_____ (A3)
d) Ability to diagnose problems in hardware and to make quality repairs	_____ (A4)
e) Ability to maintain software	_____ (A5)
f) General responsiveness of the vendor organization	_____ (A6)
g) Overall service image	_____ (A7)
h) Taking the initiative to improve user operations	_____ (A8)
i) Resolution of invoicing disputes	_____ (A9)
j) Dispatching trouble calls	_____ (A10)
k) Escalation of extended downtime	_____ (A11)

Comments: _____

2. How long does it normally require _____ to repair your equipment? _____ hours (R/A, fill in vendor name.)
(R1)
3. What is your requirement for hardware service response time?
_____ hours.
(R2)
4. What is the average time it takes _____ (vendor to) respond? _____ hours. (R/A, fill in vendor.)
(R3)
5. When local software or modifications to system software are required to support _____'s (vendor) peripherals or terminals, what are your requirements in the case of:

	Required (hours)	Actual Average (hours)
a) Response time of software engineer when system is inoperable	_____ (R4)	_____ (R5)
b) Response time when system is significantly degraded	_____ (R6)	_____ (R7)
c) Response time when problem is circumvented with mild degradation	_____ (R8)	_____ (R9)

6. a) What overall level of availability do you require of your equipment (Availability is defined as the ratio of scheduled usage divided by the sum of scheduled time plus downtime plus recovery time.) _____ %
(R10)
- b) What level availability are you experiencing? _____
(R11)
7. What level of availability do you require of your equipment during your most critical periods? _____ %
(R12)

8. a) Please rank the 3 most critical applications using your _____
_____ equipment with 1 being most critical (R/A, fill in
appropriate vendor designation in blank space).
- b) On a scale of 1-10, with 10 representing critical to the survival
of your business, how critical does downtime become during the
following applications?

Applications	(a) Rank	(b) Rate
Order Entry/Accounts Receivable	_____ (A12)	_____ (A13)
Purchasing/Accounts Payable	_____ (A14)	_____ (A15)
General Ledger Accounting	_____ (A16)	_____ (A17)
Payroll	_____ (A18)	_____ (A19)
Materials/Inventory Controls	_____ (A20)	_____ (A21)
Cost Accounting	_____ (A22)	_____ (A23)
Engineering, Design/CAD	_____ (A24)	_____ (A25)
Process Control/CAM	_____ (A26)	_____ (A27)
PERT /CPM	_____ (A28)	_____ (A29)
Time Sharing	_____ (A30)	_____ (A31)
Reservations	_____ (A32)	_____ (A33)
Scientific Analysis	_____ (A34)	_____ (A35)
Business Modelling	_____ (A36)	_____ (A37)
Business Graphics	_____ (A38)	_____ (A39)
Transaction Control	_____ (A40)	_____ (A41)
Other _____	_____ (A42)	_____ (A43)

9. On a scale of 1-10, how important is a single source of maintenance to you? (1 = no importance, 5 = worth serious consideration, 10 = absolutely necessary) _____
(A51)
10. Do you employ third-party maintenance for any of your equipment?
Yes/No _____
(C1)
11. Have you considered third-party maintenance as a single source?
Yes/No _____
(C2)
12. Would you consider a maintenance management contract as an alternative to a single source or third-party? The management contract would provide you with a single interface to all vendors. Yes/No _____
(C3)

* DATA ENTRY: Questions 10-12 are single character entries, either "Y," or "N," or nothing.

13. Do you have a requirement for any of the following services, and if so, what would you consider a reasonable premium to pay over the basic maintenance charge?

Service	* Yes /No	Reasonable Premium (percent)
a) Stand-by coverage during critical periods	<u> </u> (C4)	<u> </u> % (A52)
b) Guaranteed uptime	<u> </u> (C5)	<u> </u> % (A53)
c) Guaranteed response time	<u> </u> (C6)	<u> </u> % (A54)
d) On-site spare parts	<u> </u> (C7)	<u> </u> % (A55)
e) Remote diagnostics	<u> </u> (C8)	<u> </u> % (A56)
f) Preventive maintenance and field changes during off-prime hours	<u> </u> (C9)	<u> </u> % (A57)
g) Occasional shift coverage (versus fixed schedule)	<u> </u> (C10)	<u> </u> % (A58)
h) Full-time, on-site service engineer	<u> </u> (C11)	<u> </u> % (A59)
i) Guaranteed repair time (hardware)	<u> </u> (C12)	<u> </u> % (A60)
j) Guaranteed turnaround on software fixes	<u> </u> (C13)	<u> </u> % (A61)

* DATA ENTRY: For "Yes/No" column see note on preceding page.

14. a) Please rate, on a scale of 1-10, your requirements for the following vendor goods and services.
- b) Please rate your current level of satisfaction with the goods and services you receive from your equipment and/or maintenance vendor.

Vendor Goods and Services	Scale 1-10	
	Requirement (a)	Current Level (b)
Environmental Planning	_____ (A62)	_____ (A63)
Physical Site Planning	_____ (A64)	_____ (A65)
Consulting	_____ (A66)	_____ (A67)
Documentation	_____ (A68)	_____ (A69)
Training	_____ (A70)	_____ (A71)
Installation Planning	_____ (A72)	_____ (A73)
Hardware Maintenance	_____ (A74)	_____ (A75)
Software Maintenance	_____ (A76)	_____ (A77)
Supplies Sales	_____ (A78)	_____ (A79)
Add-on Sales	_____ (A80)	_____ (A81)
Site Audits	_____ (A82)	_____ (A83)
Relocation	_____ (A84)	_____ (A85)
De-installation	_____ (A86)	_____ (A87)

15. Would you favor or oppose having the field service engineer in a sales role for the following:

	Favor		Neutral	Oppose	
	Strongly	Mildly		Mildly	Strongly
Supplies	<u> </u> (B1)	<u> </u> (B2)	<u> </u> (B3)	<u> </u> (B4)	<u> </u> (B5)
Hardware features	<u> </u> (B6)	<u> </u> (B7)	<u> </u> (B8)	<u> </u> (B9)	<u> </u> (B10)
Add-on equipment	<u> </u> (B11)	<u> </u> (B12)	<u> </u> (B13)	<u> </u> (B14)	<u> </u> (B15)
New models of equipment	<u> </u> (B16)	<u> </u> (B17)	<u> </u> (B18)	<u> </u> (B19)	<u> </u> (B20)
Upgrades	<u> </u> (B21)	<u> </u> (B22)	<u> </u> (B23)	<u> </u> (B24)	<u> </u> (B25)
Software packages	<u> </u> (B26)	<u> </u> (B27)	<u> </u> (B28)	<u> </u> (B29)	<u> </u> (B30)

16. Regarding your maintenance contracts, which of the following provisions do you favor or oppose?

	Favor	Neutral	Oppose
Long-term contracts > 1 year	<u> </u> (B31)	<u> </u> (B32)	<u> </u> (B33)
Automatic renewal	<u> </u> (B34)	<u> </u> (B35)	<u> </u> (B36)
Variable shift coverage	<u> </u> (B37)	<u> </u> (B38)	<u> </u> (B39)
Standardized forms (versus negotiated contracts)	<u> </u> (B40)	<u> </u> (B41)	<u> </u> (B42)
Annual invoicing	<u> </u> (B43)	<u> </u> (B44)	<u> </u> (B45)

17. Assuming appropriate discounts or premiums as applicable, please rate the relative importance of receiving your hardware and software maintenance by the following methods: (scale 1-10)

	(1-10)	
	Hardware	Software
Traditional, on-site response to trouble calls	<u> </u> (A89)	<u> </u> (A90)
Your involvement in diagnosis working with support center without remote diagnostics	<u> </u> (A91)	<u> </u> (A92)
Your involvement in diagnosis with remote diagnostics	<u> </u> (A93)	<u> </u> (A94)
Your involvement replacing circuit boards, other components, or patching software	<u> </u> (A95)	<u> </u> (A96)
Delivering portable modules to repair centers	<u> </u> (A97)	<u> </u> (A98)
On-site stand-by of service personnel during critical periods.	<u> </u> (A99)	<u> </u> (A100)

18. Do you favor or oppose the unbundling of maintenance requirements?

	Favor	Neutral	Oppose
Hardware	<u> </u> (B46)	<u> </u> (B47)	<u> </u> (B48)
Software	<u> </u> (B49)	<u> </u> (B50)	<u> </u> (B51)

19. In your opinion, what changes should _____
(vendor) make to significantly improve the level of service?

20. Are the improvements needed generally throughout field service or
just at _____(vendor)?

Comments: _____

APPENDIX B: DATA BASE FILE, FORMATS,
AND ACCESS METHODOLOGY

APPENDIX B: DATA BASE FILE, FORMATS, AND ACCESS METHODOLOGY

A. DATA BASE OVERVIEW

- The user requirements data base is held at INPUT on Apple computers using the CP/M operating system.
- Data entry was accomplished using Ashton-Tate's dBASE II relational data base management system. The same system was used to create the raw data printouts already delivered.
- The data base for peripheral and terminal product users is contained in three raw data files and one numeric file created from quantifiable raw text data.
 - FPTIA.DBF 69K
 - FPTIB.DBF 66K
 - FPTIC.DBF 33K
 - FPTID.DBF 18K

B. DESCRIPTION OF FILES

- Exhibits B-1 through B-4 list the field names and structure of the four files as originally created under dBASE II.
 - These field names and parameters are contained in the four dBASE II structure files (FPT1A.DBF, FPT1B.DBF, etc.).
 - Fields are easily recognizable by the corresponding question numbers and/or data cell descriptors in the questionnaire reproduced in Appendix A.
 - The listings contain additional information about the data type, maximum allowable characters in the field, and the number of decimal positions.
 - For example, in Exhibit B-1, the "Q2" field (number 18) is type "N" (numeric), is 7 characters wide (6 numerals and a decimal point), and contains 2 decimal positions.
 - A second example in Exhibit B-1 is the field "VENDOR," which contains alphanumeric characters (C) and has a maximum capacity of 20 characters (20).
- FPT1A is a raw data file containing demographic data (some of which has been removed to protect the users), vendor, product, and responses to questions 1 through 7.
- FPT1B is a raw data file containing responses to questions 8 through 13 and question 17. Raw data is contained in this file in the form of text for yes and no answers to certain questions; these text data are transformed later into numerical equivalents in FPT1D.

EXHIBIT B-1

FPT1A DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Zip	C	005	
003	Industry	C	030	
004	Area	C	003	
005	Vendor	C	020	
006	Product	C	020	
007	Q1:A	N	002	
008	Q1:B	N	002	
009	Q1:C	N	002	
010	Q1:D	N	002	
011	Q1:E	N	002	
012	Q1:F	N	002	
013	Q1:G	N	002	
014	Q1:H	N	002	
015	Q1:I	N	002	
016	Q1:J	N	002	
017	Q1:K	N	002	
018	Q2	N	007	002
019	Q3	N	007	002
020	Q4	N	007	002
021	Q5:A:REQ	N	007	002
022	Q5:A:ACT	N	007	002
023	Q5:B:REQ	N	007	002
024	Q5:B:ACT	N	007	002
025	Q5:C:REQ	N	007	002
026	Q5:C:ACT	N	007	002
027	Q6:A	N	006	002
028	Q6:B	N	006	002
029	Q7	N	006	002

EXHIBIT B-2
FPT1B DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Q8:1:APP	C	031	
003	Q8:1:RATE	N	003	
004	Q8:2:APP	C	031	
005	Q8:2:RATE	N	003	
006	Q8:3:APP	C	031	
007	Q8:3:RATE	N	003	
008	Q9	N	003	
009	Q10:Q12	C	009	
010	Q13:Y:N	C	034	
011	Q13:A	N	005	001
012	Q13:B	N	005	001
013	Q13:C	N	005	001
014	Q13:D	N	005	001
015	Q13:E	N	005	001
016	Q13:F	N	005	001
017	Q13:G	N	005	001
018	Q13:H	N	005	001
019	Q13:I	N	005	001
020	Q13:J	N	005	001
021	Q17:A89	N	002	
022	Q17:A90	N	002	
023	Q17:A91	N	002	
024	Q17:A92	N	002	
025	Q17:A93	N	002	
026	Q17:A94	N	002	
027	Q17:A95	N	002	
028	Q17:A96	N	002	
029	Q17:A97	N	002	
030	Q17:A98	N	002	
031	Q17:A99	N	002	
032	Q17:A100	N	002	

EXHIBIT B-3
FPT1C DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	Q14:A62	N	002	
003	Q14:A63	N	002	
004	Q14:A64	N	002	
005	Q14:A65	N	002	
006	Q14:A66	N	002	
007	Q14:A67	N	002	
008	Q14:A68	N	002	
009	Q14:A69	N	002	
010	Q14:A70	N	002	
011	Q14:A71	N	002	
012	Q14:A72	N	002	
013	Q14:A73	N	002	
014	Q14:A74	N	002	
015	Q14:A75	N	002	
016	Q14:A76	N	002	
017	Q14:A77	N	002	
018	Q14:A78	N	002	
019	Q14:A79	N	002	
020	Q14:A80	N	002	
021	Q14:A81	N	002	
022	Q14:A82	N	002	
023	Q14:A83	N	002	
024	Q14:A84	N	002	
025	Q14:A85	N	002	
026	Q14:A86	N	002	
027	Q14:A87	N	002	
028	Q15	C	018	
029	Q16	C	015	
030	Q18	C	006	

EXHIBIT B-4

FPT1D DBF

FIELD	NAME	TYPE	WIDTH	DEC
001	Cat:No	N	005	001
002	C1	N	002	
003	C2	N	002	
004	C3	N	002	
005	C4	N	002	
006	C5	N	002	
007	C6	N	002	
008	C7	N	002	
009	C8	N	002	
010	C9	N	002	
011	C10	N	002	
012	C11	N	002	
013	C12	N	002	
014	C13	N	002	
015	B1	N	002	
016	B6	N	002	
017	B11	N	002	
018	B16	N	002	
019	B21	N	002	
020	B26	N	002	
021	B31	N	002	
022	B34	N	002	
023	B37	N	002	
024	B40	N	002	
025	B43	N	002	
026	B46	N	002	
027	B49	N	002	

- FPTIC is a raw data file containing responses to questions 14, 15, and 18. As in FPTIB above, certain text data will be transformed into numerical equivalents in FPTID as discussed below.
- FPTID is a file created from certain raw text data in FPTIB and FPTIC substituting numerical ranges for responses:
 - Yes/no responses (C1-C13) are translated as follows:
 - . No = -1
 - . Yes = +1
 - . No answer = 0
 - The text responses (check marks) to B1-B30 found in FPTIC become numeric data in FPTID found in the related fields named B1, B6, ..., B26 with the following translation:
 - . Favor strongly = +2
 - . Favor mildly = +1
 - . Neutral = 0
 - . Oppose mildly = -1
 - . Oppose strongly = -2
 - Similarly, the text responses from FPTIC in B31-B51 become numeric data in FPTID fields B31, B34, ..., B49 with three levels of translation:
 - . Favor = +1
 - . Neutral = 0
 - . Oppose = -1
- Linkage of the files is accomplished with the questionnaire catalog number (CAT:NO) field, which is common in all four files for each respondent to the questionnaire.

- Gaps in catalog number sequence are normal; the files have been completely edited for linkage consistency.
- The "CAT:NO" field contains one decimal position to allow the insertion of late responses into the proper sequence.
- The requirement of multiple files was imposed by constraints in dBASE II and the desirability of restoring the files to a popular CP/M-based data base management system.

APPENDIX C: PERIPHERAL/TERMINAL USERS INTERVIEWED

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- 1ST FEDERAL SAVINGS
- 500 LINE RAILROAD
- ABBOT LABORATORIES
- ADDRESSOGRAPH-MULTIGRAPH
- ADVANCE REFRIGERATOR CO.
- AETEC INDUSTRIES
- AJ BAYLESS MARKETS
- ALABAMA STATE UNIVERSITY
- ALBERTA CULVER CORP.
- ALBERTSON'S INC.
- ALLIED PRODUCTS CORP.
- ALLIED TUBE AND CONDUCT
- ALLSTATE INSURANCE CO.
- ALLSTATE RESEARCH CENTER
- ALTON ACHHSNER HOSPITAL FOUNDATION
- ALTON OCHSNER HOSPITAL
- AMERICAN BAR ASSOCIATION
- AMERICAN CAST IRON PIPE
- AMERICAN GUARANTY FINANCE CORP.
- AMERICAN MARINE INDUSTRIES
- AMERICAN MEDICAL INTERNATIONAL
- AMERICAN MOTORS
- AMF CUNO DIVISION
- AMPEX CORP.

- ANHEUSER-BUSCH
- ANDERSON ELECTRIC CORP.
- ANDERSON JACOBSEN INC.
- ANDERSON JACOBSON INC.
- ANGELES METAL SYSTEMS
- ANNUITY BOARD
- ANNUITY BOARD SO. BAPTIST CON.
- APPERSON BUSINESS FORMS
- APPLIED DATA SYSTEMS
- ARDEN MAYFAIR INC.
- ARNOLD ENGINEERING
- ASPEN SKIWEAR
- ASSOCIATED GROCERS OF CO.
- ATLANTA NEWSPAPERS
- AUTOMOBILE CLUB OF MI.
- AVCO CORPORATION
- ARIZONA DEPARTMENT OF TRANSPORTATION
- BALDWIN DATA SERVICES
- BECHTEL POWER CORP.
- BENDER SHIP BUILDING
- BENDIX ANIONICS
- BENDIX CORP.-WARNER SWASEY CO.
- BERGEN BRUNSWIG CO.
- BETTER PACKAGES INC.
- BEURMANN MARSHARL CORP.
- BIBLE COMPANY
- BLUE CROSS HOSPITAL SERVICE
- BLUE CROSS HOSPITAL SERVICES
- BOARD OF COOP EDUCATIONAL SERV.
- BOOLE & BABBAGE
- BORG WARNER CORP.
- BOSTON & MAINE RAILROAD
- BUNKER RAMO

- BUREAU OF ELECTRICITY
- C R INDUSTRIES
- CALIFORNIA DEPARTMENT OF HEALTH & WELFARE
- CALIFORNIA STATE AUTO ASSOCIATION
- CALVIN COLLEGE
- CAROLINA STEEL CORP.
- CASCADE NATURAL GAS
- CASCADE NATURAL GAS CORP.
- CATERPILLAR TRACTOR CO.
- CECO STEEL PROD.
- CENTRAL CARTAGE CO.
- CENTRAL MOLONEY DIV. OF COLT
- CENTRAL TEXAS COLLEGE
- CHERRY BEKAERT AND HOLLAND
- CHERRY CREEK SCHOOL
- CHICAGO TRANSIT AUTHORITY
- CHURCH OF JESUS CHRIST
- CITIZENS SAVINGS & LOAN
- CITY OF BURBANK INFORMATION
- CITY OF FRESNO - FINANCE DEPT.
- CITY OF GARLAND
- CITY OF LA HARBOR DEPT.
- CITY OF TUCSON
- CLERK OF CIRCUIT COAST
- CLERK OF CIRCUIT COURT
- COCA COLA
- COLORADO NATIONAL BANK
- COMMONWEALTH LIFE INSURANCE
- COMPUTER COMPANY
- COMPUTER SCIENCES CORP.
- COMSERV CORP.
- CONNECTICUT AIRE CONDITIONING

- CONTINENTAL SCALE
- COSCO INDUSTRIES CONSOLIDATED
- CPHA
- CREATIVE COMPUTER SERVICES INC.
- CREIGHTON UNIN.
- CUMMINS ALLISON CORP.
- CUTLER HAMMER
- CYBER SYSTEMS
- DALLAS COUNTY DATA CENTER
- DANA CORP.
- DATACRAFT INC.
- DELMAR COMPANY
- DU PONT
- DULLAM RANCH
- DURACELL PRODUCTS
- EASTERN KENTUCKY UNIVERSITY
- ECKO HOUSEWARES CO.
- EDUCATION SERVICE CENTER
- EDWARDS CO. INC.
- ENERCO INDUSTRIES INC.
- ESTES EXPRESS LINES
- EVEREST & JENNINGS
- FAIRCHILD CONTROL SYSTEMS
- FAR WEST SERVICES
- FEDERAL RESERVE BANK
- FIRST NATIONAL BANK OF COMMERCE
- FORD AEROSPACE & COMMUNICATION
- FOUR PHASE INC.
- FURNAS ELECTRIC CO.
- GATES RUBBER
- GENERAL DYNAMICS
- GENERAL SEMI-CONDUCTOR INDUS.
- GLOBAL DATA CORP.

- GLOBAL TERMINAL CONTAINER
- GM CORP.
- GRIFFIN WHEEL CO.
- GUARDIAN INDUSTRIES
- GUY F. ATKINSON CO.
- H.A. SELMER
- HAMPTON ROADS & SANITATION DIS.
- HERCULES
- HOUSTON INFORMATION SYSTEMS
- HOWARD S. WRIGHT CONSTRUCTION
- HUGHES AIRCRAFT
- HUMANA INC.
- HUNT WESSON FOOD
- HUNTINGTON BEACH H.S. DISTRICT
- HUNTINGTON BEACH SCHOOL DISTRICT
- ICI AMERICA INC.
- IDAHO STATE LAW ENFORCEMENT
- INDIANA INSURANCE GROUP
- INFRARED INDUSTRIES
- INSLAW INC.
- ITT CANNON ELECTRIC
- ITT COURIER
- JAMES SEWELL CO.
- JEFFERSON COUNTY PUBLIC SCHOOLS
- JIM WALTER COMPUTER
- JOY MANUFACTURING
- K-TRON INTERNATIONAL
- KAISER FOUNDATION HOSPITAL
- KARTRIDG-PAK CO.
- KINGSBURY MACHINE TOOL CORP.
- KNAUF FIBER GLASS
- LAURENCE LIVERMORE SCI. LABS
- LONG BEACH UNIFIED SCHOOL DISTRICT

- LOS ANGELES TIMES
- LUTHERAN BROTHERHOOD
- MAGNUSON COMPUTER SYSTEMS
- MAJERS MARKET RESEARCH
- MANATEE JUNIOR COLLEGE
- MARICOPA COUNTY
- MEASUREX CORP.
- MEDICARD
- METROPOLITAN STEVEDORE CO.
- MICHIGAN STATE UNIVERSITY
- MIDLAND FEDERAL SAVINGS
- MISSISSIPPI BAPTIST HOSPITAL
- MNEMOTECH COMPUTER
- MOBILE PRE-MIX
- MONTGOMERY COLLEGE
- MULTNOMAK COUNTY
- MUTUAL OF OMAHA
- MUTUAL PROTECTIVE INSURANCE
- NATIONAL BANK OF WASHINGTON
- NATIONAL SERVICE INDUSTRIES
- NATIONAL AUTO & CASUALTY INSUR.
- NAVAL REGIONAL MEDICAL HOSP.
- NAVIGATING SERVICE
- NEBRASKA PUBLIC POWER CO.
- NEW HAMPSHIRE COLLEGE
- NORTH CENTRAL COMPANY
- NORTHLAND FINANCIAL CO.
- NW UNIVERSITY REGISTRAR'S OFFICE
- OLYMPIA BREWING CO.
- OUTBOARD MARINE CORP.
- PACIFIC TELEPHONE
- PARADYNE CORPORATION
- PAY FONE SYSTEMS

- PEMCO CORP.
- PETRO LEWIS CORP.
- PFAUDLER CO.
- PHYSICIANS MUTUAL INS.
- PHYSICIANS MUTUAL INSURANCE
- PL PORTER CO.
- PORT OF SEATTLE
- POWERTEC INC.
- PPG INDUSTRIES
- PRECISION CASTPARTS CORP.
- PUBLIC SERVICE COMPANY
- REGAL BELOIT CORPORATION
- REGAL TUBE
- RENFRO HOSIERY MILLS
- REPCO INC.
- RESEARCH MEDICAL CENTER
- REXNARD INC.
- REYNOLDS ALUMINUM
- REYNOLDS METALS
- ROCKWELL INTERNATIONAL
- ROCKWELL-COLLINS GRL. AVIATION
- SACRAMENTO COUNTY
- SAMSONITE CORP.
- SAN MATEO CO.
- SANTA BARBARA COUNTY
- SAUDER INDUSTRIES
- SECURE DATA CORP.
- SECURITY FIRST GROUP
- SECURITY LIFE OF DENVER
- SIMPSON TIMBER CO.
- SIX FLAGS CORP.
- SOUTHEAST COMMUNITY COLLEGE
- SOUTHWEST GAS CORP.

- SPRING CITY KNITTING CO.
- STANLEY WORKS
- STATE COMP. INSURANCE FUND
- STATE OF ARIZONA
- TACOMA BOATBUILDING
- TANNER COMPANIES
- TEALE DATE CENTER #2
- TELEDYNE RYAN AERO CO.
- TEXAS COMMERCE BANK
- TEXAS FARM BUREAU
- TEXAS PARKS & WILDLIFE
- THRALL CAR MANUFACTURING CO.
- TRANSAMERICA INFORMATION SERVICE
- TRI COUNTY METROPOLITAN TRANSIT
- TROY STATE UNIVERSITY
- TRW INC.
- U-HAUL INTERNATIONAL
- U.S. DEPARTMENT OF JUSTICE
- UNIGARD INSURANCE GROUP
- UNION ELECTRIC CO.
- UNION INSURANCE COMPANY
- UNIVERSITY HOSPITAL
- UNIVERSITY OF GEORGIA
- UNIVERSITY OF NEBRASKA
- U.S. NAVY CONSTRUCTION BATTALION
- VARIAN ASSOCIATES
- VICTOR BUSINESS PRODUCTS
- WESTERN GROCERS
- WESTERN SOUTHERN LIFE INSURANCE
- WESTINGHOUSE ELECTRIC
- WILKENS ANDERSON COMPANY
- WILMINGTON TRUST CO.
- WORLD AIRWAYS INC.
- WURLITZER CO.

